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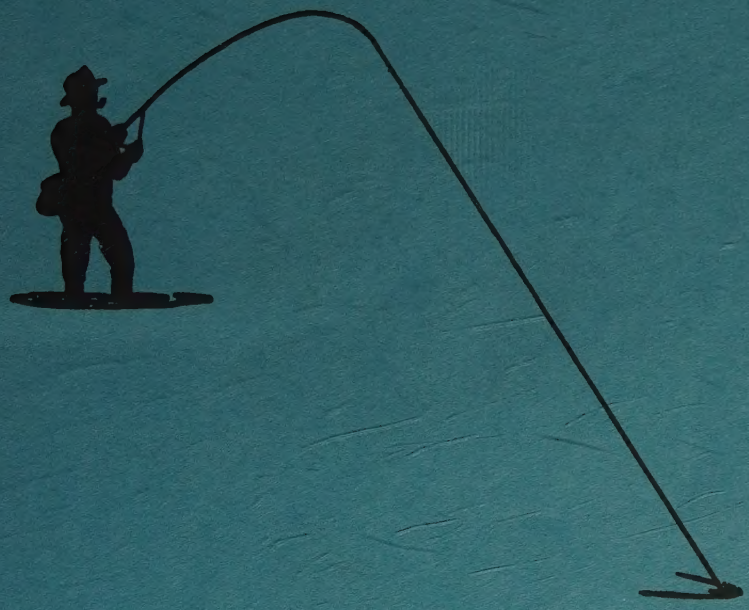

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Sport Fishery Abstracts

An abstracting service for fishery research and management

Vol. 3, No. 3 Abstracts 1667-1920 July 1958

Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
Raymond E. Johnson, Chief
William R. Beckmann, Editor
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CORRECTION - Abstract No. 1328 of Vol. 3, No. 1, third paragraph should read:

Electrosampling in 1955, the first year after treatment, indicated that at least temporary benefits were derived from the project. The sampling, which was largely restricted to the tributary streams, showed that the juvenile steelhead population increased about 13 times, while at the same time the rough fish population was drastically reduced.

1667. Bullock, Wilbur L. 1958. THE BLOOD PROTOZOA OF THE MARINE FISH OF SOUTHERN NEW ENGLAND. The Journal of Parasitology, Vol. 44, No. 4, Sect. 2, pp. 24-25.

During the summer of 1953, in the course of work at the Fish and Wildlife Service Laboratory in Woods Hole, Massachusetts, blood smears were made and examined from 209 fish representing 43 species. Of these, 14 fish (6 species) were infected with some species of blood protozoa. Haemogregarina sp. was observed in 4 of 19 Paralichthys dentatus. A probable infection with a haemogregarine was observed in 1 to 6 Spheroides maculatus and a haemogregarine-like parasite was found in the white blood cells of 1 of 7 Centropristis striatus. Trypanosoma rajae was observed in 1 of 8 Raja erinacea. All infections were relatively to extremely light.

A myxosporidian, apparently Kudoa sp., was observed in the blood of Pseudopleuronectes americanus (6 of 26) and Fundulus heteroclitus (1 of 8). In several of these fish the parasites were numerous. All infected fish, 6 of 12 P. americanus, were from the same locality (Nonamessett Island).

In the following fish no blood protozoa were observed: Caranx crysos (1), Ceratacanthus schoepfi (2), Cynoscion regalis (2), Cyprinodon variegatus (8), Dasyatis centrura (1), Echeneis naucrates (2), Fundulus majalis (13), Hyporhamphus unifasciatus (1), Leptocephalus conger (5), Lamanda ferruginea (1), Lophius piscatorius (1), Lophopsetta maculata (1), Menidia notata (3), Menticirrhus saxatilis (1), Microgadus tomcodi (4), Mustelus canis (3), Myoxocephalus aeneus (3), Oligoplites saurus (2), Opsanus tau (3), Pomatomus saltatrix (4), Poronotus triacanthus (1), Prionotus carolinus (6), P. strigatus (2), Pteroplana micrura (1), Raja diaphanes (2), R. eglanteria (3), Scomber scombrus (1), Selar crumenophthalmus (14), Sphyraena borealis (3), Stenotomus chrysops (16), Strongylura marina (1), Syngnathus fuscus (2), Tautoga onitis (13), Tautogolabrus adsperus (6), Tetranarce occidentalis (1), Trichiurus lepturus (1), and Urophycis regius (3). (Auth. abst.)

1668. Hugghins, Ernest J. 1958. STUDIES ON PARASITES OF FISHES IN SOUTH DAKOTA. The Journal of Parasitology, Vol. 44, No. 4, Sect. 2, p. 33.

The first extensive study of the parasites of fishes to be undertaken in South Dakota is being conducted with the cooperation of the South Dakota Department of Game, Fish and Parks and the Agricultural Experiment Station at South Dakota State College. Two bulletins on the results will be forthcoming. The first will be designed primarily for the nonparasitologist (e.g., for the fishery biologist, game warden, and sportsman). The second will be more technical and will give tables showing the incidence and distribution of all worm and arthropod parasites found.

More than 400 fishes from about 25 different bodies of water (largely lakes) have been examined for worm and arthropod parasites. A preliminary list of parasites found is here presented. Trematoda: Phyllodistomum staffordi, Triganodistomum spp., Posthodiplostomum minimum centrarchi, Uvulifer ambloplites, Diplostomulum trilobum, Clinostomum marginatum (the last 4 being metacercariae). Cestoda: Glaridacris catostomi, Monobothrium ingens, Ligula intestinalis, Marsipometra hastata, Bothriocephalus cuspidatus, Corallobothrium fimbriatum, C. giganteum, Proteocephalus pinguis, P. ambloplitis, P. fluviatilis, Proteocephalus spp. Nematoda: Contracaecum spiculigerum, Contracaecum sp., Camallanus oxycephalus, Philometra nodulosa, Cystidicola sp. Acanthocephala: Pomphorhynchus bulbocolli. Hirudinea: Piscicola punctata. Copepoda: Argulus biramosus, Achtheres ambloplitis, Lernaea cyprinacea.

Some of these parasites are quite widespread in South Dakota. Some of them appear to be restricted to a single host species, while others show little host specificity. In a few lakes, the incidence of certain parasites is extremely heavy. These and other factors will be discussed in the final report. (Auth. abst.)

1669. Meyer, Marvin C. 1958. STUDIES ON PHILONEMA AGUBERNACULUM, A DRACUNCULOID NEMATODE INFECTING SALMONIDS. The Journal of Parasitology, Vol. 44, No. 4, Sect. 2, p. 42.

Adult Philonema agubernaculum (Simon and Simon, 1936, Parasitol. 28: 440-442), occurring beneath the serous membrane encysted on the viscera or free in the body cavity, is a serious parasite in landlocked salmon (Salmo salar) and Eastern brook trout (Salvelinus fontinalis) in Maine lakes. The multiple mesenteric and serosal adhesions, evoked by the presence of the worms, may be so severe, especially in older fish, that neither normal spawning nor stripping is possible. This species, like other dracunculoids, is characterized by the relatively enormous length of the females as compared with the midget males, and by the fact that in the course of ontogeny the vulva and vagina atrophy, leaving the body of the gravid female almost entirely occupied by the larvae-filled uterus. When gravid females are placed in water they move slowly and burst within 2 minutes, protruding a coil of uterus through the ruptured body wall, while, at the same time, literally thousands of larvae are discharged as a teeming white cloud. Larvae have remained viable in lake water for 14 days, during which Cyclops sp. were infected. A month later these infected copepods were fed to hatchery-reared, fingerling salmon with inconclusive results. Available forage fish, consisting of lake chubs (Hybopsis plumbea), golden shiners (Notemigonus crysoleucas), American smelt (Osmerus mordax), were examined as possible intermediate hosts, using a modified pepsin-HCl digestion technique. All were found negative for philonemids, although both viable larvae and adult nematodes of other species were recovered. (Auth. abst.)

1670. Leigh, W. Henry. 1958. THE LIFE-HISTORY OF MACRODEROIDES SPINIFERUS PEARSE, 1924, A TREMATODE OF THE FLORIDA SPOTTED GAR, LEPISOSTEUS PLATYRHINCUS. The Journal of Parasitology, Vol. 44, No. 4, pp. 379-385.

Helisoma durvi, a common pulmonate snail of South Florida is frequently infected with a xiphidiocercaria which penetrates and encysts in the muscle tissue of several species of small fishes, the most abundant being Gambusia affinis holbrooki. Tadpoles may also serve as intermediate hosts. Metacercariae in fish become infective in 14 days and after being eaten by the Florida spotted gar, Lepistosteus platyrhincus, become sexually mature in the small intestine in 10-12 days. The adults, identified as Macroderoides spiniferus Pearse, 1924, were found in 47% of the gar examined.

Eggs of this trematode are embryonated and infective when deposited but hatch only after ingestion by the snail host. Daughter sporocysts are located adjacent to the intestine and produce cercariae approximately 30 days after infection of the snail host. (Auth. summ.)

1671. Bassett, Howard M. 1958. FURTHER LIFE HISTORY STUDIES OF TWO SPECIES OF SUCKERS IN SHADOW MOUNTAIN RESERVOIR, GRAND COUNTY, COLORADO. Colorado Cooperative Fisheries Research Unit Quarterly Report, Vol. 4, pp. 28-30.

Both species of sucker were found to migrate up the three accessible tributary streams during the spawning period. The spawning migrations of 1957 began on May 26 and ended about July 18 in the North Fork Inlet of the reservoir. The spawning migrations in the North Inlet and East Inlet of Grand Lake apparently began and ended on later dates than in the North Fork Inlet. Spawning western white suckers outnumbered spawning western longnose suckers in all three inlets. Spawning male suckers outnumbered spawning female suckers at the stream spawning sites. Western white males appeared to slightly outnumber western white females migrating up the tributary streams. A definite stream temperature was not found to govern the date on which the stream spawning migrations began. The greater part of the spawning migrations occurred at night.

About 11 percent of the stream-migrating female western white suckers apparently absorbed their eggs without spawning. Both male and female western white suckers lost weight during the spawning period. Incubation periods for western white sucker eggs at the following average daytime temperatures were: 64 degrees fahrenheit, 5 days; 61 degrees, 7 days, 60 degrees, 7 days; 56.5 degrees, 11 days. Most young suckers hatched in the streams apparently descended to the reservoir during the fry stage. Increases in stream temperatures during the day were associated with an increase in the number of fry descending the streams. A few young suckers of up to 35 millimeters in length were observed to remain in the North Fork Inlet.

Large resident populations of suckers were not found in the tributary streams of Shadow Mountain Reservoir. Indications were that reproduction by stream resident suckers did not contribute appreciably to the numbers of sucker fry descending to the reservoir. Stream reproduction by suckers migrating from the reservoir apparently contributed large numbers of suckers to the reservoir population.

While spawning suckers showed a tendency to return to a particular stream, there was no evidence to indicate that any one of the three accessible inlets were utilized in greater proportion than the other two. Migrating suckers, marked in the North Fork Inlet, appeared to mingle freely throughout both Shadow Mountain Reservoir and Grand Lake following the spawning period.

It was estimated that there were 213,996 suckers of over 10 inches in length present in Shadow Mountain Reservoir and Grand Lake during August and September of 1957, or 81.8 pounds of suckers of over 10 inches in length per surface acre of water in Shadow Mountain Reservoir and Grand Lake.

A few local areas of the reservoir displayed a lack of oxygen in the water during the winter of 1956-1957, but evidence indicating that this oxygen lack resulted in a winter kill of fish could not be found.

Entomostracans, the principal items in the summer diet of both species of suckers, were apparently absent from the diets of both suckers during the winter. During the winter months, the western white sucker stomachs examined contained principally vascular plants, filamentous algae, and Tendipedidae larvae. The western longnose sucker stomachs examined contained principally vascular plants, and filamentous algae.

During the winter months, adults of both species of suckers weighed more than during the summer months. Immature western white suckers weighed somewhat less during the winter months than during tne summer months.

Any adequate sucker control program would have to be carried out on a continuing basis over a period of time. To effectively reduce the sucker population in Shadow Mountain Reservoir it appears that a combination of all possible control measures would have to be employed in the reservoir and in adjacent waters including Grand Lake and the three tributary streams. (From auth. abst.)

1672. Hoffman, Glenn L. 1958. STUDIES ON THE LIFE-CYCLE OF ORNITHODIPLOSTOMUM PTYCHOCHEILUS (FAUST) (TREMATODA: STRIGEOIDEA) AND THE "SELF CURE" OF INFECTED FISH. The Journal of Parasitology, Vol. 44, No. 4, pp. 416-421.

The life cycle of Ornithodiplostomum ptychocheilus is described. Adults were obtained by force-feeding baby chicks with metacercariae from

the mesenteries and brain of the shiner (Notropis cornutus frontalis) and fathead (Pimephales p. promelas) and mesenteries of the creek chub (Semotilus a. atromaculatus). Snails (Physa anatina) were infected with the resulting miracidia, and the sporocysts and cercariae are described. Fish (Pimephales p. promelas, Notropis d. dorsalis, Semotilus a. atromaculatus) were experimentally infected and the development of the metacercaria and cyst is described. A bursting of the body wall of the fish, resulting in release of metacercatiae ("self-cure") is described. The histopathology of the infected fish is briefly described. (Auth. summ.)

1673. Barnhart, Roger Allen. 1958. CHEMICAL FACTORS AFFECTING THE SURVIVAL OF GAME FISH IN A WESTERN COLORADO RESERVOIR. Colorado Cooperative Fisheries Research Unit Quarterly Report, Vol. 4, pp. 25-28.

Sweitzer Lake located near Delta, Colorado, constructed by the Colorado Game and Fish Department during 1954, has been stocked with black bullhead, bluegill, channel catfish, largemouth bass, rainbow trout, white crappie, and yellow walleye. Almost a complete mortality has occurred after each introduction. It has been tentatively concluded on the basis of available data that these mortalities probably resulted from the toxic effects of selenium, possibly acting in synergism with other ions such as uranium or zinc.

Preliminary investigations which involved basic field chemistries of Sweitzer Lake water, pH and temperature determinations, revealed no values lethal to fish. Fish survived for an extended period in aquaria containing Sweitzer Lake water and in live-boxes in Sweitzer Lake. On the basis of these investigations it appeared that the factor affecting the survival of game fish in Sweitzer Lake was not a function of the water itself. Food and age-growth studies demonstrated that the fish food in Sweitzer Lake was adequate.

The presence of trace elements were suspected as a result of information obtained from the literature (e.g. Byers, 1936) and because of the occurrence of mining in the regions surrounding Sweitzer Lake. Although the water did not appear toxic to fish, it seemed possible that the fish accumulated these trace elements in lethal amounts through ingestion in the food chain.

Analyses were made of soil and water to determine the presence of a number of trace elements suspected to occur in the area. Tests revealed that unusual concentrations of arsenic, selenium, uranium, and zinc existed in the Sweitzer Lake drainage. Samples of deeper water and sediment from Sweitzer Lake contained extremely high concentrations of selenium as did the soil in the drainage above the lake.

Samples of the flora and fauna of Sweitzer Lake were analyzed for the above four elements. Stanleys, a reported selenium indicator, contained greater than 300 p.p.m. selenium. Potamogeton contained high concentrations of selenium. Anax, a dragonfly nymph, which formed a definite part of the food chain in Sweitzer Lake contained excessive amounts of selenium.

The livers of the flannelmouth sucker and roundtail chub, native to the area and present in the lake, had accumulated selenium to a degree toxic to some mammals. Histo-pathological examination of the livers of the flannelmouth sucker and roundtail chub demonstrated positive symptoms of the presence of toxic materials in the body.

Though all possibilities were not examined, it is believed that selenium is passed up through the food chain to the fish which accumulate the element in lethal concentrations. It was recommended that certain tests be conducted prior to construction of future impoundments which would help to insure the chances for provision and maintenance of quality fishing. (From auth. abst.)

1674. Rollefson, Max Dean. 1958. THE DEVELOPMENT AND EVALUATION OF INTERRUPTED DIRECT CURRENT ELECTROFISHING EQUIPMENT. Colorado Cooperative Fisheries Research Unit Quarterly Report, Vol. 4, pp. 38-40.

The present study was initiated to develop a pulsating unit to exploit the advantages of interrupted direct current for electrofishing, and to investigate the feasibility of a lethal electric downstream barrier for the purpose of preventing immigration of carp, Cyprinus carpio, into a chemically-treated reservoir.

The pulsating unit consists of a motor-driven commutator and brush assembly. The pulse shape was an abruptly peaked rectangular wave form. A 35 per cent duty cycle was selected for experimentation. Under controlled shocking conditions utilizing rainbow trout and brown trout, as test animals, a repetition rate of 95.2 pulses per second was selected as a near-optimum frequency for subsequent field study. Power requirements for various electrical wave forms tested are discussed.

Electrofishing results in streams of northeastern Colorado utilizing 230 volts pulsed direct current 230 volts steady direct current, and 230 volts, alternating current were compared. Pulsed current was superior to the steady equivalent direct current voltage for fish collection work in moderately conductive streams; in resistive streams it was necessary to increase the basic direct current voltage in order to approach the electrofishing efficiency of 230 volts alternating current. Average pulsed voltages tested ranged from 150 to 205 volts. The latter voltage was necessary for acceptable fish collection results in resistive water of 42,343 ohm centimeters at 50°F. For work in conductive water of 1,226 ohm centimeters at 70°F., average pulsed voltage was reduced to 36 volts. Average pulsed voltage of this magnitude produced electrofishing results comparable with 63 volts steady direct current.

Water resistivity, volume of flow, and width and depth of stream were important variables from a

standpoint of power requirements. The influence of these variables is discussed and possible means of circumvention are suggested.

Based upon the needs determined during controlled fish shocking experiments and field tests, a variable voltage pulsating unit was constructed. A multi-tap transformer and full-wave rectification circuit allows a choice of alternating current or direct current voltage from 100 volts to 700 volts. The direct current voltage may be interrupted by means of the pulsating unit, achieving power economy and the added physiological stimulation of pulsed current. This unit should provide the versatility required by variations in water resistivity encountered in Colorado, and should produce more effective electrofishing results. Caution in voltage selection should minimize fish mortality during stream electrofishing operations.

Means are sought to prevent the reintroduction of carp, an undesirable fish species, into recently rehabilitated reservoirs. Aquarium experiments, simulating a lethal electric barrier, were performed to determine the individual effects of alternating current voltage and current density in producing 100 per cent mortality of carp. An increase in voltage intensity from 115 to 330 volts reduced necessary exposure periods from 270 seconds to 11 seconds. Groups of carp from two different habitats were exposed to electric fields of similar current density. At three current densities, four to six times more energy was required for 100 per cent mortality of the carp from the more resistive habitat. During the electrocution experiments, some individual carp from a single, otherwise homogeneous population were noted to be particularly resistant to electric shock. These variations in resistance of carp to electric shock are a serious obstacle to the development of a satisfactory lethal electric downstream barrier. (From auth. abst.)

1675. Powell, Guy C. 1958. EVALUATION OF THE EFFECTS OF A POWER DAM WATER RELEASE PATTERN UPON THE DOWNSTREAM FISHERY. Colorado Cooperative Fisheries Research Unit Quarterly Report, Vol. 4, pp. 31-37.

Investigations during the summer of 1957 revealed that the effects of water discharges from Green Mountain Power Dam in north central Colorado reduced bottom fauna populations, trout feeding success, and trout growth.

Effects of water releases were determined by comparing biological data collected in the Blue River below the dam with those collected from the undisturbed Blue River above Green Mountain Reservoir. Insect weights per square foot above the reservoir were over 32 times greater and never less than 2.5 times greater than the weights per square foot below the dam. Effects were also determined by analyzing the severity of the bottom fauna reductions at various distances below the dam. Insect populations increased downstream from the dam.

Power dam water releases are detrimental to the downstream fishery because they produce reduced minimum flows, chemical and temperature changes depending on seasonal weather conditions, severe water fluctuations, and great flushing action. (Auth. abst.)

1676. Garside, E. T., and J. S. Tait. 1958. PREFERRED TEMPERATURE OF RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON) AND ITS UNUSUAL RELATIONSHIP TO ACCLIMATION TEMPERATURE. Canadian Journal of Zoology, Vol. 36, No. 4, pp. 563-567.

The modal preferred temperatures of rainbow trout acclimated to 5° C., 10° C., 15° C., and 20° C. were determined photographically to be 16° C., 15° C., 13° C., and 11° C., respectively. The final preferendum was 13° C. The phenomenon of decreasing preferred temperature with increasing acclimation temperature has not been reported for any other species of fish. (Auth. abst.)

1677. Gagnon, Andre. 1958. LA TOXICITE DU DDT POUR LE SAUMON DE L'ATLANTIQUE (SALMO SALAR LINNE) ET LES ALEVINS DE TRUITE (SALVELINUS FONTINALIS MITCHILL). Canadian Journal of Zoology, Vol. 36, No. 4, pp. 479-487. (in French)

The relative sensitivity of brook trout fry, salmon fry, and 1- and 2-year old parr to known quantities of DDT was studied in hatchery-trough experiments with larger numbers of specimens than were used by previous workers. In troughs, in which part-time water circulation was achieved and DDT used at the rate of 0.5 lb/acre (0.32 p.p.m.), high mortality rates (93-100%) were recorded for salmon fry, trout fry, and 1-year-old parr. Moreover, it was shown that group susceptibility decreases in the following manner: salmon fry to 1-year-old parr to trout fry. In another series of experiments, under identical conditions, it was shown that sensitivity in salmon decreases with age. Using salmon fry, in troughs deprived of water circulation, a study was made of the effects of various concentrations of DDT: 0.33, 0.18, 0.072 and 0.36 p.p.m. corresponding to 0.5, 0.25, 0.1, and 0.05 lb. of DDT/acre, respectively. The average lethal dose (L.D. 50) was found to be 0.072 p.p.m. A comparison between two series of experiments shows how mixing of the DDT with water makes the poison more deadly than when used as a DDT-oil solution on the surface of water. (Auth. abst.)

1678. Cohen, Daniel M. 1958. A REVISION OF THE FISHES OF THE SUBFAMILY ARGENTININAE. Bulletin of the Florida State Museum, Biological Sciences, Vol. 3, No. 3, 173 pp.

A systematic revision of the Argentininae divides the subfamily into two genera, Argentina with seven species and subspecies and Glossanodon with five species. Comments are given on habits and distribution, and brief discussions of the swim bladder and spiral valve are included. The following new taxa are presented: Prosoarchus, new subgenus; Glossanodon (Glossanodon) polli, new

species; Glossanodon (Prosoarchus) pygmaeus, new species; Argentina elongata australiae, new subspecies. (Auth. abst.)

1679. Ramaswami, L. S., and A. B. Lakshman. 1958. SPAWNING CATFISH WITH MAMMALIAN HORMONES. Nature, Vol. 182, No. 4628, pp. 122-123.

Catfish (Heteropneustes, Clarias) have previously been reported to respond to large doses of mammalian chorionic gonadotrophins yielding viable eggs hatching into fry. The reactions of catfish not only to them but also to the same hormones used in combination with a threshold dose of catfish pituitary gland are recorded.

Two important points emerge from the bioassays. First, thyroid-stimulating hormone has been found to be an ovulating agent. Second, growth hormone, oestrogen, androgen, and progesterone act as synergic agents when used along with a threshold dose of catfish pituitary gland, whereas pregnant mare serum, adrenocorticotropic hormone, and oxytocin are ineffective.

1680. Larimore, R. Weldon. 1957. ECOLOGICAL LIFE HISTORY OF THE WARMOUTH (CENTRARCHIDAE). Illinois Natural History Survey Bulletin, Vol. 27, No. 1, 83 pp.

This species was studied intensively in two habitats of central Illinois, a 3.2-acre artificial impoundment stocked only with warmouth and largemouth bass and a 18-acre flooded stripmine area containing a fish population of 36 species. Habitat characteristics, food habits, reproduction, growth, parasitism, behavior, and economic relations are covered.

1681. Charles, James R. 1957. FINAL REPORT ON POPULATION MANIPULATION STUDIES IN THREE KENTUCKY STREAMS. Kentucky Department of Fish and Wildlife Resources Fisheries Bulletin No. 22, pgs. 1-45.

This paper presents the findings of a Dingell-Johnson project that has been concerned since 1952 with the manipulation of populations in 3 streams typical of types found in the state, i.e., excessive numbers of rough fish in proportion to the numbers of game fish, generally clear most of the year, relatively cool waters and rocky bottoms. The upper 46 miles of North Fork River in Mason County and 12 miles of Whippoorwill Creek in Logan County were treated with 5 percent powdered rotenone in 1952 to eradicate their entire fish populations. Both streams were immediately restocked with game and panfish species. Annual sampling of the population of both streams revealed a gradual reversion to the original population composition in each stream. It was concluded that total population manipulation could be accomplished, and at no more prohibitive cost than other comparable management techniques, but that any benefit to the game fish species was of questionable value and of short duration. Similar findings resulted from removing undesirable species from 11.5 miles of Floyd's Fork Creek, Bullitt County, with an electric seine during 1955.

All available evidence indicates that partial or total population manipulation alone, without environmental alteration or improvement, holds little promise as a management tool for improving the population composition of the average Kentucky stream. (From auth. abst.)

1682. Beatty, Lee D., and Frank F. Hooper. 1958. BENTHIC ASSOCIATIONS OF SUGAR-LOAF LAKE. Papers of the Michigan Academy of Science, Arts, and Letters, Vol. 43, Part I, pp. 89-106.

Samples of bottom fauna, submerged plants, and bottom soil were collected at 22 stations within the littoral zone of this shallow eutrophic lake in Washtenaw County. Soil samples were quite uniform in texture and chemical composition. The principal variation was a higher ash content and a slight decrease in organic matter of the shallow-water sediments and the sediments of exposed shores. Chara was the predominant submerged plant except in the central depression and in the more protected bays. Here Najas and Potamogeton were more important. Certain species appeared to be associated with depth and soil conditions; other forms appeared to be distributed rather uniformly. Two midges, Tanytarsus jucundus and Glyptotendipes, were concentrated in a small area that could be distinguished from the rest of the basin by depth, soil, or vegetation type.

Three biotic associations for the littoral zone are described. These associations are distinguished on the basis of soil and vegetation characteristics and quantitative differences in animal assemblages. (From auth. summ.)

1683. Bersamin, Silvestre V. 1958. A PRELIMINARY STUDY OF THE NUTRITIONAL ECOLOGY AND FOOD HABITS OF THE CHUBS (LEUCICHTHYS SPP.) AND THEIR RELATION TO THE ECOLOGY OF LAKE MICHIGAN. Papers of the Michigan Academy of Science, Arts, and Letters, Vol. 43, Part I, pp. 107-118.

Of the 2,437 stomachs analyzed, 41 percent contained identifiable organisms or remains, 33 percent contained food too thoroughly digested to identify, and 26 percent were empty. Pontoporeia hoyi Smith was the predominant organism, with 60 percent occurrence; Mysis relicta Loven followed with 38.1 percent occurrence. Generally either was found, but in some instances, both occurred in the same stomach. Pontoporeia had been eaten by chubs taken within the depth range of 9 to 70 fathoms and was most abundant in stomachs of those fish caught at about 14 to 23 fathoms. Mysis occurred in greatest numbers in stomachs of chubs taken from 71 to 74 fathoms, were most common in those fish caught at 25 to 49 fathoms, and were found in stomachs of fish from 14 to 74 fathoms. Pontoporeia occurred

more frequently in the food of chubs during June and July; Mysis occurred more frequently in July though they continued abundant through August. Chubs were found to eat various available aquatic and terrestrial insects, occasional larval forms of mollusks, plant matter, organic detritus, and their own eggs.

1684. Hill, Donald R. 1958. SOME USES OF STATISTICAL ANALYSIS IN CLASSIFYING RACES OF THE AMERICAN SHAD (Alosa sapidissima). Biometrics, Vol. 14, No. 2, pp. 291-292.

Each year pound nets fished in the ocean off the coast of New York and New Jersey catch large quantities of shad. Most of these fish are native to the Hudson and Connecticut Rivers and should be considered in any management plan for the two rivers. However, estimates of the racial composition of this catch are required before these catches can be included.

An analysis of variance of some meristic counts made on these fish indicated that the differences between rivers were considerably larger than differences between years and within a given river. This information provided additional evidence of the existence of races.

Using these meristic counts, a discriminant function was constructed which would separate a large proportion of a mixed population. The function was constructed from data obtained on Hudson River shad in 1939 and Connecticut River shad in 1945.

The meristic data from a sample of 105 fish obtained from the Hudson River in 1940 was substituted into the discriminant function. Very good agreement was obtained between the theoretical number of misclassifications and the actual number. Methods of estimating the racial composition using the classifications obtained from the discriminant function are also discussed. (Auth. abst.)

1685. Nicholls, A. G. 1958. THE TASMANIAN TROUT FISHERY. II. THE FISHERY OF THE NORTHWEST REGION. Australian Journal of Marine and Freshwater Research, Vol. 9, No. 1, pp. 19-59.

A brief account is given of the several rivers, and of the results derived from the study of the fishery in each. Anglers' returns of catches have been analyzed with respect to the daily catch per angler for nine seasons, and the lengths of fish for five seasons, and the results are similar for each river. Detailed consideration of a summary of the data received from all sources in this region shows a definite downward trend in the daily catch which is statistically significant and more pronounced in the estuarine than in the inland fishery. There has been no change in the mean lengths of fish taken, and the size distribution of the catch has remained constant over five seasons. An 80 percent annual mortality rate has been found for fish from 1 to 6 years of age, after which it falls slightly. The total annual catch has risen with the increase in licensed anglers. Analysis of the diary of one angler over 27 years shows a decline in the catching rate, but the mean weight of fish has remained fairly constant. No direct consistent correlation was found between the estuarine trout fishery and the commercial whitebait fishery. It is concluded that the decline in catching rate is probably related to a change in the representation of anglers making returns during the nine seasons. A study of the contribution made by the release of hatchery fish shows a maximum possible return to anglers of 2 percent, subject to a correction for the proportion of takable fish caught by anglers for which no data are available. Evidence is produced to show that the release of hatchery fish is unproductive and wasteful in a stream already stocked to capacity. (Auth. abst.)

1686. Ronald, Keith. 1958. THE METAZOAN PARASITES OF THE HETEROSOMATA OF THE GULF OF ST. LAWRENCE. IV. CESTODA. Canadian Journal of Zoology, Vol. 36, No. 3, pp. 429-434.

Diplocotyle olrikii, Clestobothrium crassiceps, Bothriocephalus scorpii, and B. claviceps; Scolex pleuronectis, Phyllobothrium sp. (larva), and a tetraphillidean plerocercoid (Cestoda) were identified in a study of 560 specimens of Heterosomata (Hippoglossoides platessoides, Hippoglossus hippoglossus, Limanda ferruginea, Liopsetta putnami, Pseudopleuronectes americanus, and Scophthalmus aquosus) from the Gulf of St. Lawrence area. The distribution of the hosts is indicated. (Auth. abst.)

1687. Anderson, G. C. 1958. SOME LIMNOLOGICAL FEATURES OF A SHALLOW SALINE MEROMICTIC LAKE. Limnology and Oceanography, Vol. 3, No. 3, pp. 259-270.

Seasonal variations of some physical, chemical, and biological features were studied from December 1954 to October 1956 in Hot Lake, a shallow saline body of water occupying a former epsom salt excavation in north central Washington. The lake is meromictic and during the period of study had an average salt gradient of approximately 100 g/liter at the surface to 400 g/liter at the bottom, the major salt being magnesium sulfate. The mixolimnion was thin enough that the monimolimnion was heated directly by the sun, with the result that temperatures in excess of 50°C were recorded in the monimolimnion during summer. Much of this heat was retained during the winter. The calculated value of heat gain in the monimolimnion agreed reasonably well with the observed value. The flora consisted mainly of Chara, a bottom mat of blue-green algae, and a dense population of green sulfur bacteria in the upper part of the monimolimnion. Artemia salina was the dominant zooplankter, and some features of its life history as affected by the unusual thermal properties of the lake are described. (Auth. abst.)

1688. Gorham, Eville. 1958. OBSERVATIONS ON THE FORMATION AND BREAKDOWN OF THE

OXIDIZED MICROZONE AT THE MUD SURFACE IN LAKES. Limnology and Oceanography, Vol. 3, No. 3, pp. 291-298.

Evidence is presented indicating that the winter thickness of the oxidized microzone at the surface of lake muds may depend upon turbulent displacement of the uppermost sediments into the overlying aerated water, as well as upon the reducing power of the sediments themselves. It is also suggested that this winter oxidized layer may disappear mainly from the surface downward, owing to the greater oxygen consumption there brought about by decomposition of sedimented plankton. Lastly, evidence for a final evolutionary phase of lake sterility, due to development of extremely reducing conditions in the bottom mud, is examined and rejected. (Auth. abst.)

1689. Hayes, F. R., and E. H. Anthony. 1958. LAKE WATER AND SEDIMENT. I. CHARACTERISTICS AND WATER CHEMISTRY OF SOME CANADIAN EAST COAST LAKES. Limnology and Oceanography, Vol. 3, No. 3, pp. 299-307.

Sixteen lakes are described, varying in geology and all but two of low productivity, and including three acid bog types. A method is described for indirect estimation of the sum of Na and K. In lakes generally, low pH is related to low conductivity, but in these coastal lakes the Na in ocean spray keeps up the conductivity even in very acid waters. At equilibrium the inorganic P in solution is 2-3 ppb and represents a residual soluble fraction, independent of productivity and pH. Total P is 10-15 ppb and the concentration is not related to productivity. There is an annual cycle of inorganic P with a winter maximum, spring decline, and summer minimum. Methyl orange alkalinity varies directly with the sum of Ca and Mg and with either of the ions separately. The scatter in the regression of alkalinity versus Mg is greater than that of alkalinity versus Ca. There is a reduction of percent organic material in the sediments directly related to increasing alkalinity. The cause is attributed to greater bacterial activity as the pH goes up. (Auth. abst.)

1690. Hayes, F. R., B. L. Reid, and M. L. Cameron. 1958. LAKE WATER AND SEDIMENT. II. OXIDATION-REDUCTION RELATIONS AT THE MUD-WATER INTERFACE. Limnology and Oceanography, Vol. 3, No. 3, pp. 308-317.

Redox potentials of mud cores from seven lakes, including acid bog, unproductive, and productive types, were measured with Mortimer's multiple electrode. A break existed below the surface, but variation in measurement was too great to characterize its depth within $\pm$ 30-50%. Accuracy of potential measurement is limited by lack of poise, so that the scatter of units of the multiple electrode increases as a standard solution or a natural mud is diluted with distilled water. With the muds studied the scatter was $\pm$ 50 mv. In poorly poised systems the area of platinum is also important, so that potentials of 0.01 to 0.42 volts were obtained on the same sample with electrodes of different sizes. The presence of H_2S causes a voltage drop, e.g., 20-min. bubbling of a reduced solution with H_2S caused the voltage to fall from 0.63 to 0.17 v. Production of H_2S in nature is abolished by O_2. As a further difficulty the sediments of some lakes are able to deposit a sulphide plating on submerged platinum. Evidence is presented that the real oxidized layer is one mm or less thick, and that the reported break in the electrode curve at about one cm is caused by factors other than oxidation of iron salts, e.g., turbulent stirring of the sediment by wind-induced currents, and presence of sulphide. (Auth. abst.)

1691. MacPherson, L. B. 1958. LAKE WATER AND SEDIMENT. III. THE EFFECT OF pH ON THE PARTITION OF INORGANIC PHOSPHATE BETWEEN WATER AND OXIDIZED MUD OR ITS ASH. Limnology and Oceanography, Vol. 3, No. 3, pp. 318-326.

Dried and reconstituted mud from pairs of primitive, medium, productive, and acid bog lakes was shaken to phosphorus equilibrium with water. Minimal P was released at pH 5.5-6.5, and ranged from scarcely above the level of chemical detection up to 0.2 ppm in productive lakes. Further acidity caused a slight increase of P in the water, up to 0.3 ppm, and alkalinity a larger increase, up to 0.5 ppm. At all pH levels the quantity released increased in the order of lake types stated above. The pH versus P curve for whole mud was shallow or saucer-shaped; ashed mud gave a similar but deeper or cup-shaped curve. Thus a productive lake ash at pH 4 released 1.0 ppm and at pH8, 1.2 ppm. When 1 ppm of P was added to the water prior to the shaking, the lake type reacted differently. Acid bog and productive lake muds left the added P in the water, while unproductive lake muds removed most of it under acid conditions but not at pH 7 or more. The adsorption behavior of ash is similar to that of Bentonite, Fuller's earth, or ferric hydroxide gel. (Auth. abst.)

1692. Ryther, John H., and Charles S. Yentsch. 1958. PRIMARY PRODUCTION OF CONTINENTAL SHELF WATERS OFF NEW YORK. Limnology and Oceanography, Vol. 3, No. 3, pp. 327-335.

The chlorophyll-radiation method of measuring primary production, described earlier by the authors, was employed on six oceanographic cruises during 1956-7, each occupying 25 stations across the continental shelf off New York. The relationship photosynthesis/hour (opt. light):chlorophyll a, using the oxygen production method, was found to agree with that determined earlier from culture and harbor water experiments, despite wide variations of temperature, nutrients, and the abundance ofphytoplankton. The same ratio, with photosynthesis measured by C^{14} uptake, was extremely variable and usually lower than that obtained by oxygen-production photosynthesis values.

Estimates of daily production beneath a square meter of sea surface by the chlorophyll-radiation method and in situ C^{14} values agreed within reasonable limits in 75% of the measurements; for the remainder of the times the C^{14} values were con-

sistently lower.

Daily production throughout the year ranged roughly from 0.20 to 1.00 g carbon/m^2/day within the whole area studied. Estimated annual production decreased in a seaward direction from 160 g carbon/m^2/year in the shallow coastal waters to 100 g carbon/m^2/year on the continental slope. These values are intermediate between Riley's estimates for Long Island Sound and the Sargasso Sea. (Auth. abst.)

1693. Shimada, Bell M. 1958. DIURNAL FLUCTUATION IN PHOTOSYNTHETIC RATE AND CHLOROPHYLL "A" CONTENT OF PHYTOPLANKTON FROM EASTERN PACIFIC WATERS. Limnology and Oceanography, Vol. 3, No. 3, pp. 336-339.

Measurements were made of photosynthetic activity and chlorophyll "a" content of phytoplankton samples taken at regular intervals over a 46-hour period in May 1957, from surface waters near Clarion Island in the eastern Pacific Ocean. Results confirm previous observations of a diurnal periodicity in photosynthesis which, in this particular instance, appears to be correlated with variations in chlorophyll content. The photosynthesis-chlorophyll relationship gives an estimated value of 4.24 mg C/hr per mg of chlorophyll "a" at a light intensity of 1000 foot-candles. (Auth. abst.)

1694. Aron, William. 1958. THE USE OF A LARGE CAPACITY PORTABLE PUMP FOR PLANKTON SAMPLING, WITH NOTES ON PLANKTON PATCHINESS. University of Washington, Department of Oceanography, Technical Report No. 59, 23 pgs.

A centrifugal pump with rated capacity of 400 gallons/minute was used for plankton in Puget Sound. With the ship under way, 50 simultaneous paired hauls were made with the pump and a 0.5-meter nylon plankton net. The pumped water was passed through a special filtering unit and damage to the plankters was negligible. Data show remarkable agreement between catches of fish eggs captured by the pump and two nets. Large discrepancies between catches of motile organisms by the pump and tow net cannot be explained in terms of gear selectivity. Plankton patchiness--nonuniform distribution of planktonic organisms--is suggested as the explanation for the variations which occur between the two sampling devices on a paired haul. The use of large capacity pumps is recommended for further investigations of horizontal and vertical distribution of plankton. (Auth. abst.)

1695. Keenleyside, Miles H. A. 1958. COMPARATIVE EFFECTS OF THE INSECTICIDES DDT AND MALATHION ON YOUNG ATLANTIC SALMON. Progress Reports of the Atlantic Coast Stations, Fisheries Research Board of Canada, No. 69, pp. 3-6.

Tests were conducted on young Atlantic salmon averaging 3.5 inches long. Solutions of DDT in solvent oil (Picco HiSolv 473K) were prepared in the same proportions as in the aerial spray used for spruce budworm control. Malathion was mixed in the same proportions in the same solvent oil.

TL_m values for DDT of 0.049 and 0.047 ppm were obtained for 24-hour and 48-hour tests. TL_m values for Malathion were identical for both the 24- and 48-hour tests, 0.033 ppm. Thus, Malathion was found to be more toxic to salmon than DDT; both will evidently kill salmon in extremely small amounts. The solvent oil itself was found to be very toxic to young salmon.

1696. Mossman, Archie S. 1958. SELECTIVE PREDATION OF GLAUCOUS-WINGED GULLS UPON ADULT RED SALMON. Ecology, Vol. 39, No. 3, pp. 482-486.

Glaucous-winged gulls killed proportionately many more female than male red salmon in two spawning streams in Alaska. In addition, the gulls were much more likely to eviscerate the females than the males. The mechanisms that may enable gulls to selectively kill the females, and those that may permit the salmon to maintain strong sexual dimorphism in the face of such stringent selection, are discussed. The tentative conclusion reached is that the characters of the salmon that result in this selective predation are ones that cannot be dispensed with by the female salmon and cannot now, in the face of this strong selection, be attained by the male. (Auth. summ.)

1697. Skud, Bernard Einar. 1958. RELATION OF ADULT PINK SALMON SIZE TO TIME OF MIGRATION AND FRESHWATER SURVIVAL. Copeia, No. 3, pp. 170-176.

Yearly fluctuations in the average size of pink salmon appear to be uniform throughout the Southeastern Alaska fishery which suggests that these fish are affected as a unit by environmental factors met during their ocean existence. During years in which the fish are large the runs tend to appear earlier than in years in which the runs consist of smaller fish. Also within a season, fish arriving earlier are larger than individuals arriving later in the same run.

At Sashin Creek, Little Port Walter, Alaska, statistical evidence suggests that years of early runs may provide for better survival of young during the fresh water incubation than years of late runs. (From auth. abst.)

1698. Reid, George K. 1958. SIZE DISTRIBUTION OF FISHES IN A TEXAS ESTUARY. Copeia, No. 3, pp. 225-231.

Increase in size of individuals from the upper region toward the mouth of an estuary has been shown for several species. A similar pattern in salinity increase is typical of estuarine waters. Studies of East Bay, near Galveston, yield enlightening data on this apparent relation of salinity to fish size. Excavation of Rollover Pass between East Bay and Gulf of Mexico was completed in the second of the three years of study, and was partially inoperative during the

third year providing three different salinity patterns.

These studies strongly indicate that salinity, per se, is not the cause of the size distribution cline. This is based primarily on the fact that the original natural distribution pattern was maintained during the first two seasons, during which the salinity gradient in the estuary was essentially reversed. Also, since salinity variations between many areas during the last year of study often was no more than 2-3 percent, the fish would have to have been acutely halitactic to have been distributed as found.

1699. Hartman, G. F. 1958. MOUTH SIZE AND FOOD SIZE IN YOUNG RAINBOW TROUT, SALMO GAIRDNERI. Copeia, No. 3, pp. 233-234.

Rainbow trout fry, caddis fly larvae with cases removed, and stonefly nymphs were fed young rainbow trout which had been starved for 72-182 hours. The width of a fish's mouth and the maximum width of the organisms taken (swallowed or rejected) were recorded. Findings indicate that, although mouth size imposes a limit on size of food swallowed, the structure and reaction of food organisms effects a control of organism size below that allowed by mouth-size alone. Small fry were easily swallowed; large caddis fly larvae and many smaller stonefly larvae attached themselves to the snout of the fish and were rejected.

1700. Mather, Frank J., III, and Robert H. Gibbs, Jr. 1958. DISTRIBUTION OF THE ATLANTIC BIGEYE TUNA, THUNNUS OBESUS, IN THE WESTERN NORTH ATLANTIC AND THE CARIBBEAN SEA. Copeia, No. 3, pp. 237-239.

An account of catches of bigeye tuna which when combined provide a pattern of continuous distribution from the northern coast of Venezuela, through the Caribbean Sea, north along the coast of North America. With one exception, all records for the U. S. coast are for the months of September, October, and November.

1701. Sundnes, G., T. Enns, and P. F. Scholander. 1958. GAS SECRETION IN FISHES LACKING RETE MIRABILE). The Journal of Experimental Biology, Vol. 35, No. 3, pp. 671-676.

Gas secretion has been studied in three species of salmonid fishes, one of which accumulates both nitrogen and oxygen against considerable gradients, while the other two accumulate only nitrogen. None of these three species possesses a counter-current system (rete mirabile) which could step up a slight primary pressure effect. Neither the nitrogen nor the oxygen capacity of the blood is large enough to account for the tensions found in the swimbladder by a simple one-step diffusion process.

One is forced therefore to consider a mechanism for active transport of these gases by the cells lining the swimbladder. (Auth. summ.)

1702. Beadle, L. C. 1958. MEASUREMENT OF DISSOLVED OXYGEN IN SWAMP WATERS. FURTHER MODIFICATION OF THE WINKLER METHOD. The Journal of Experimental Biology, Vol. 35, No. 3, pp. 556-565.

A modification of the iodine-difference Winkler method is described which involves a preliminary clarification of a single sample, from which two smaller samples were siphoned. This makes possible estimations on extremely muddy and polluted water and avoids an error in the standard iodine-difference method which is very large with highly polluted waters.

The iodine is added with the clarifying reagents to the original sample, thus avoiding the necessity for quantitative addition of iodine to two separate samples, which is another potential source of error in the standard method. Estimations on swamp water saturated with air under standard conditions indicate that the method is accurate to within 0.2 mg. O_2/l.

With polluted water, having an oxidation-reduction potential of less than +100 mV., 'negative' figures for oxygen content are obtained. The cause of this phenomenon could not be discovered but, since this potential indicates anaerobic conditions, the method is not thereby affected.

An improved iodine-titration end-point is described involving the use of a magnetic stirrer.

Direct spectrophotometric estimation of iodine is shown to be as accurate as, and very much more rapid than titration, and particularly suited to the iodine-difference method. (Auth. summ.)

1703. Morris, R. 1958. THE MECHANISM OF MARINE OSMOREGULATION IN THE LAMPERN (LAMPETRO FLUVIATILIS L.) AND THE CAUSES OF ITS BREAKDOWN DURING THE SPAWNING MIGRATION. The Journal of Experimental Biology, Vol. 35, No. 3, pp. 649-664.

Some fresh-run lamprey can osmoregulate in 50% sea water where they can maintain plasma freezing-point depressions of about 0.57°C. An analysis of the mechanism of osmoregulation in these animals shows that it is similar in many respects to that employed by marine teleosts. The lampern swallows sea water and absorbs a solution containing a high proportion of monovalent ions into its blood. It has been calculated that chloride is excreted by an extra-renal route, presumably by means of chloride excretory cells which have been discovered in the gills. The rate of extra-renal loss of water is high and the urine output is negligible.

Many fresh-run animals are unable to osmoregulate. In some cases the capacity to swallow sea water becomes reduced, while in others the number of chloride excretory cells is diminished--an indication that the extra-renal excretory mechanism is failing. Both of these mechanisms regress simultaneously in some animals. (Auth. summ.)

1704. Nicholls, A. G. 1958. THE POPULATION OF A TROUT STREAM AND THE SURVIVAL OF RELEASED FISH. Australian Journal of Marine

and Freshwater Research, Vol. 9, No. 3, pp. 319-350.

The fish population of a river system was studied by electro-fishing in 25 places, after which 1000 marked yearling brown trout, Salmo trutta L., were released at each of 10 sites. In a re-examination 8 to 9 months after the release it was estimated that about 10 percent of these were surviving; the survival after 18 months was estimated to be below 5 percent, and the survival to takable size, at about 3 years of age, at 2 percent. At no site were the younger age groups of the natural population truly represented in either season, but the numbers of older fish in the second season were greater than those of the corresponding year classes in the preceding season, showing that the streams receive recruitment of younger fish from other sources. Some evidence is produced to show that "nursery" streams provide the source of recruitment. The average annual mortality for fish of 2 and 3 years of age is estimated at from 70 to 80 percent for the system. It is estimated that there were about 45,000 takable fish in this river system at the beginning of each season. It is shown that the mean lengths of trout decrease with increasing density of population, and that there is a curvilinear relationship between population density and total weight of all fish per acre. The standing crop of trout at different sites ranged from 1 to 182 lb/acre over the two seasons. The condition factor showed a decrease with increasing age of the fish, and the released fish had a lower factor than resident fish of the same age at all sites. In general there was a relationship between the depth of water and the length of the fish, sections over 14 in. deep having greater populations of larger fish. A study of the ability of each section of stream to carry fish, based on the lengths and condition factors of the fish, the number and weight of the population per acre, and the ability of each section to absorb additions to the population, shows that where populations were low, conditions were less favourable to the growth and survival of fish. (Auth. abst.)

1705. Daisley, K. W., and L. R. Fisher. 1958. VERTICAL DISTRIBUTION OF VITAMIN B_{12} IN THE SEA. Journal of the Marine Biological Association of the United Kingdom, Vol. 37, No. 3, pp. 383-385.

Sea-water samples were taken from various depths in the Bay of Biscay in May and June of 1956 and 1957.

Low vitamin B_{12} concentrations were found in the upper illuminated zone and in the greatest depths (mean value for seven samples, 0.57 mμg/l.; standard deviation 0.19 mμg/l.), whereas at intermediate depths (190-2110 metres) the values were generally higher, up to 5.0 mμg/l. in two instances (mean value for 34 samples, 2.26 mμg/l.; standard deviation 1.22 mμg/l.)

Evidently there exists a considerable variation with depth of the vitamin B_{12} concentration in the sea region sampled at this season. It remains for further research to show what causes this vertical variation to exist, and what influence, if any, it has on life in these waters. (Auth. summ.)

1706. Daisley, K. W. 1958. A METHOD FOR THE MEASUREMENT OF VITAMIN B_{12} CONCENTRATION IN SEA WATER. Journal of the Marine Biological Association of the United Kingdom, Vol. 37, No. 3, pp. 373-681.

A sensitive method for the measurement of vitamin B_{12} concentration in sea water is described.

Small volumes, e.g. 10 ml., of sea water are diluted with distilled water and a microbiological assay using the fresh-water flagellate Euglena gracilis strain z is carried out. The diluted sea-water samples are enriched with a growth medium, washed inocula of the Euglena are added, and these cultures are grown for up to 2 weeks under constant conditions of temperature and illumination. The chlorophyll is then extracted from the cultures into small volumes of solvent and the optical densities measured. These optical density readings are related to the concentrations of vitamin B_{12} available to the Euglena populations during their growth. (Auth. summ.)

1707. Hasler, A. D., R. M. Horrall, W. J. Wisby, and W. Braemer. 1958. SUN-ORIENTATION AND HOMING IN FISHES. Limnology and Oceanography, Vol. III, No. 4, pp. 353-361.

The white bass, Roccus chrysops, has two principal spawning grounds 1.6 km apart on the northern shore of Lake Mendota. Fish displaced from these spawning grounds return faithfully to their respective spawning sites, and of 1366 fish marked and displaced to mid-lake, a distance of 2.4 km, 181 were recaptured in fyke nets and less than 9% erred by being recaptured at the net on the other spawning ground. Fish released at the spawning ground were not recaptured in greater percentage than those displaced and released in mid-lake.

Fish to which floats were attached for direct tracing moved generally north from the center of the lake when released on clear days. Moreover, fish released between the two spawning grounds also moved north on clear days. On cloudy days, however, or if blinded with eyecaps, they moved at random. Unexplained is how they differentiate between the two spawning areas; apparently it is by means other than with the aid of the sun.

A laboratory analysis of the sun-compass mechanism was made. An immature specimen of Lepomis macrochirus was trained, at a specific time of day, to find cover in one of sixteen boxes of a circular tank. When trained, the fish entered the training box in a consistent compass-direction at any time of the day. Under an overcast sky the choices were completely unoriented. When tested under an artificial sun, (light bulb), this fish responded as though it were the real sun, at that time of day and sought cover in the "artificial" direction, reaffirming the presence of a biological clock. White bass were also successfully trained to a compass-direction

under the natural sun.

Lepomis gibbosus was tested with another method. It too has a sun-compass mechanism.

These field and laboratory experiments suggest strongly that the sun serves as the point of reference, and that the animal compensates for its movement by a biological chronometer. (Auth. abst.)

1708. Braemer, Wolfgang, and Helga Braemer. 1958. ORIENTATION OF FISH TO GRAVITY. Limnology and Oceanography, Vol. 3, No. 4, pp. 362-372.

The equilibrium position about the transverse axis was studied in three species of Characinoidei, following the original work of von Holst.

The equilibrium position was measured in intact fish and in fish with one utricular statolith removed, under conditions in which the weight was increased from 1.0 to 2.2 g through centrifuging. Some specimens were fixed and cleared so that the position of the utricular statoliths relative to the long axis could be photographed.

The experiments show: (1) The equilibrium is a feedback process of peripheral and central factors, with the sensory receptor built into the system as the external control element. (2) Removal of one utricular statolith results in a marked weakening of the peripheral equilibrium component, but is not equal to an exact halving as should be expected from the results of other workers. This suggests that one of the other statoliths may be acting in maintaining the equilibrium position around the transverse axis. (3) The direct measurement of the morphological angle of the utricular statoliths imbedded in the body of the fish was compared with the calculated value obtained by centrifuging the whole animal. (Auth. abst.)

1709. Carpelan, Lars H. 1958. THE SALTON SEA. PHYSICAL AND CHEMICAL CHARACTERISTICS. Limnology and Oceanography, Vol. 3, No. 4, pp. 373-386.

The Salton Sea of California lying below sea level, serves as a sump for irrigation water diverted from the Colorado River. The present Sea reached its maximum size and highest surface elevation at the time of its formation in 1907. Due to evaporation at the rate of six feet per year the surface elevation fell from -195 feet to its minimum of -240 feet in 1948, the surface area decreased from about 500 square miles to about 320, and the salt content (salinity) increased from 3.6 o/oo to about 40 o/oo. Since 1948 increased "wastage" of water into the Sea has raised the surface to -235 feet (1956) and diluted the waters to a salinity of about 33 o/oo. Although the total salinity is approximately the same as that of the oceans the waters of the Sea contain a different proportion of ions, and the pH is slightly higher.

The annual range of water temperature is from 10° to 36° C. In spring the surface may become as much as 5° warmer than the bottom, but since the maximum depth of the Sea is about 12 meters, mixing by winds rapidly removes differences between surface and bottom; during most of the year (August to May) there is less than 1° C difference between surface and bottom. Concentrations of dissolved oxygen ranged up to 11.8 mg/L at the surface and 9.3 mg/L at the bottom during winter. During calm periods in summer, however, the water at depths below 8-9 meters became anoxic for periods as long as 1-3 days; the surface waters, too, became depleted of oxygen, but for only an hour or so at about dawn. Concentrations of sulfide as high as 85 μg-at./L, and of ammonia as high as 50 μg-at./L were found during the anoxic periods in summer. (Auth. abst.)

1710. St. John, Philip A. 1958. VOLUMETRIC STUDY OF ZOOPLANKTON DISTRIBUTION IN THE CAPE HATTERAS AREA. Limnology and Oceanography, Vol. 3, No. 4, pp. 387-397.

The displacement volumes of 82 zooplankton samples, collected from the offshore waters of North Carolina during May and June of 1953 and January 1954, are determined and reported. A brief review is given of the topographic and hydrographic features of the area. A comparison of zooplankton volumes is made with other areas in the eastern and western North Atlantic. In the present area, the mean zooplankton volume in May was 0.29 cc/m^3; in June, 0.28 cc/m^3; in January, 0.20 cc/m^3. The volumes of zooplankton are shown to be least in shallow coastal areas and in offshore Florida Current water and to be generally at a maximum near the mid-shelf region.

Winter volumes in the present area were about 70% of the late spring values, while north of Cape Hatteras the plankton undergoes a 50% reduction between these seasons. Over Georges Bank the winter volumes are about 15% of the spring volumes, and in Norwegian waters the winter plankton volume is less than 3% of the spring value. The relatively slight reduction in plankton volumes from spring to winter in the Cape Hatteras area appears due to (1) the proximity of the Florida Current which supplies the shelf waters with reproducing populations of oceanic plankton species, and (2) the relatively high winter water temperatures and high solar radiation which insure a moderate standing crop of phytoplankton and hence a food supply for the animal fraction of the plankton. (Auth. abst.)

1711. Mann, K. H. 1958. ANNUAL FLUCTUATIONS IN SULPHATE AND BICARBONATE HARDNESS IN PONDS. Limnology and Oceanography, Vol. 3, No. 4, pp. 418-422.

In four ponds studied, sulphate in solution was high in spring, low in autumn, while bicarbonate was low in spring, high in autumn. The fall in sulphate was probably due to reduction to sulphide which became locked up in the mud as ferrous sulphide. The fluctuation in bicarbonate was partly

due to the removal of CO_2 during photosynthesis and partly to the action of sulphuric acid when the sulphide was oxidized in winter. (Auth. abst.)

1712. Steen, H. 1958. DETERMINATIONS OF THE SOLUBILITY OF OXYGEN IN PURE WATER. Limnology and Oceanography, Vol. 3, No. 4, pp. 423-426.

A recently published revision of the absorption coefficients for oxygen in water has prompted a reinvestigation of the subject by a new micro-gasometric technique. A known volume of gas-free water (approximately 1 ml) was brought into contact with oxygen at constant pressure and temperature. The oxygen uptake and the amount of water were measured with a micrometer burette. The results obtained at 6°, 12°, 18°, and 24°C confirm the standard handbook values of Winkler and Fox to within ± 1% of a. (Auth. abst.)

1713. Yentsch, Charles S., and Ralph F. Vaccaro. 1958. PHYTOPLANKTON NITROGEN IN THE OCEANS. Limnology and Oceanography, Vol. 3, No. 4, pp. 443-448.

The ratio of cellular nitrogen and chlorophyll has been studied in cultures of marine phyto-plankton during and after recovery from nitrogen deficiency. The time factors were observed to vary together; however, the ratio was only constant when the cells were sufficient in nitrogen. Since nitrogen deficiency produced chlorotic cells in all species studied, the degree of deficiency could be ascertained by measuring the ratio of carotenoid to chlorophyll a. Thus an expression utilizing the ratio of plant pigments has been formulated to compute cellular nitrogen from chlorophyll a. This pigment:nitrogen relationship has been applied to estimate the quantity of nitrogen in natural populations of phytoplankton.

The amounts of nitrogen in phytoplankton estimated from plant pigment measurements has been observed to vary between 18-70% of the total particulate matter. (Auth. abst.)

1714. Guillard, Robert R. L., and Peter J. Wangersky. 1958. THE PRODUCTION OF EXTRACELLULAR CARBOHYDRATES BY SOME MARINE FLAGELLATES. Limnology and Oceanography, Vol. 3, No. 4, pp. 449-454.

Extracellular carbohydrate production during the growth of bacteria-free cultures of the marine flagellates Isochrysis galbana, Monochrysis lutheri, Prymnesium parvum, Dunaliella euchlora Pyraminomonas sp., Rhodomonas (?) sp., and Chlamydomonas sp. was followed by the N-ethyl carbazole method.

Carbohydrate production did not parallel cell numbers during exponential growth of any of these organisms; maximum concentrations during this phase were under 3 mg/L. Carbohydrates accumulated in all stationary cultures (having 10^6-10^7 cells/ml), to the greatest extent in Prymnesium cultures, which attained 123 mg/L. Isochrysis and Monochrysis produced 25 and 16 mg/L, respectively, while the others had under 10 mg/L even when cell disintegration was evident.

Aging cultures (not all bacteria-free) of 4 diatoms, 2 dinoflagellates, 2 additional green algae, and a cyanophyte were assayed. Concentrations ranged from 1.5 to 60 mg/L.

This suggests that the organisms studied contribute significant free carbohydrates only during late bloom conditions, when algae are abundant and under physiological circumstances resembling stationary or declining culture. (Auth. abst.)

1715. Eyster, Clyde. 1958. BIOASSAY OF WATER FROM A CONCRETION-FORMING MARL LAKE. Limnology and Oceanography, Vol. 3, No. 4, pp. 455-458.

Using a pure, bacteria-free culture of Nostoc muscorum as a bioassay test organism, it was found that the water of Bass Lake, Livingston Co., Michigan, had a severe phosphate deficiency and less severe deficiencies of K, Fe, Mn, and Mg. Emission spectrographic analyses showed that the concretions had Ca as the principal constituent, Mg as the major impurity, and Fe, Si, Mn, Al, and Sr. as minor impurities. When boiled, the lake water formed a white precipitate of $CaCO_3$, which could be presented by the addition of a very small amount of K_2HPO_4. It is suggested that concretion formation in marl lakes is associated with extreme phosphate deficiency. (Auth. abst.)

1716. Hayes, F. R., and J. E. Phillips. 1958. LAKE WATER AND SEDIMENT. IV. RADIO-PHOSPHORUS EQUILIBRIUM WITH MUD, PLANTS, AND BACTERIA UNDER OXIDIZED AND REDUCED CONDITIONS. Limnology and Oceanography, Vol. 3, No. 4, pp. 459-475.

The phosphorus equilibration pattern and rate between mud and water was the same in natural Jenkin sampler cores, in artificial cores, and in bottles in which dredged surface mud was packed by centrifuge. Thus any specific natural physico-chemical or bacteriological layering of the surface muds of lakes is relatively unimportant in phosphorus exchange. Phytoplankton or bacterial cells equilibrate within a few minutes after addition. When antibiotics are used the P^{32} remains as inorganic PO_4 and is rapidly taken up by higher plants, or in the absence of plants, there is a rapid loss of P^{32} to the mud. With one exception, in over 100 artificial systems tested, the amount of P^{32} remaining in the water at equilibrium was greater in the presence of bacteria than where antibiotic had been added. This was true whether the system was treated with nitrogen or air, i.e., was aerobic or anaerobic. After a week less than 10% of the P^{32} remained in the water of an anti-biotic treated sample, while two thirds remained in the control.

The remarkable ability of bacteria to hold phosphorus in the water might be accomplished in two ways:

1) By an acceleration of the rate of P^{32} return from the sediment to the water by bacteria in the

mud. In all experiments while the turnover time of water was generally of the same order of magnitude for all systems, the turnover time for mud was much shorter in the controls than in the antibiotic treated systems.

2) By the rapid uptake of radiophosphate by water bacteria and their ability to hold the radiophosphorus from the chemical or colloidal adsorption mechanism of the mud, which would be accomplished by incorporating the phosphate into non-participating organic compounds. An affinity, or holding back by water bacteria of P^{32} would be indistinguishable from an accelerated return to the water from the mud.

Dead plankton deposited on the mud decay and greatly increase the removal of P^{32} from the water. This reaction also is blocked by antibiotics. In bottle experiments there is a natural fallout of bacterial cells of about 4% per day. Neither the redox state of the system nor the level of lake productivity could be shown to influence either living or inorganic exchanges. The events following addition of radiophosphorus can be described as a modified first order consecutive reaction in which PO_4 yields organic P in the bodies of bacteria which in turn yields organic soluble phosphorus to the water.

The rate of exchange is measured as turnover time, which is the time required for the appearance or disappearance of as much phosphorus as is present in the test material, say phytoplankton or water or mud. Some turnover times are: water of a whole lake, one week; water in a bottle over mud, 0.5 week; return from lake sediment in nature including rooted aquatics, 1 month; from mud in a bottle, 0.5 week; from bottle mud without bacteria, 2 weeks. Equilibration of PO_4 between water and the inside of bacterial or phytoplankton cells is almost immediate, say 5 minutes, but conversion to the organic state is slower with average turnover time 0.3 days. Rooted aquatics, probably cannot take up organic P; with inorganic P their time is 0.5 week. Zooplankton are opposite in behavior, unable to use phosphorus until bacteria have made it organic; their time is then 1 day. (Auth. abst.)

1717. Ryther, J. H., C. S. Yentsch, E. M. Hulburt, and R. F. Vaccaro. 1958. THE DYNAMICS OF A DIATOM BLOOM. The Biological Bulletin, Vol. 115, No. 2, pp. 257-268.

1. A dense population of planktonic diatoms was studied over a 40-hour period in a small tidal creek on the south shore of Long Island, New York.

2. Measurements were made at frequent intervals of incident radiation, light penetration, salinity, temperature, dissolved oxygen, pH, concentration of diatom cells and their pigments, and dissolved inorganic nutrients. Photosynthesis and respiration were measured by oxygen changes in bottle experiments and estimated from in situ oxygen changes and from chlorophyll a and radiation.

3. The plankton community appeared to be nutrient-limited and consisted of a static, non-growing diatom population which was being slowly diluted by tidal action. This was indicated by the diatom counts, the behavior of their pigments (which increased throughout the day and decreased during the night) and the concentration of available plant nutrients.

4. Rates of primary production measured by three methods showed good agreement, the values ranging from 3.2 to 5.3 grams carbon assimilated/m^2./day on June 26, from 5.1-6.2 on June 27. Total incident radiation for the two days was 300 and 740 gram calories/cm^2./day, respectively, and the efficiency of the photosynthetic utilization of visible radiation for the two days was estimated at 2.6% and 1.6%, respectively. (Auth. summ.)

1718. Fänge, Ragnar, and Jonathan B. Wittenberg. 1958. THE SWIMBLADDER OF THE TOADFISH (OPSANUS TAU L.) The Biological Bulletin, Vol. 115, No. 2, pp. 172-179.

The anatomy of the swimbladder and the gas gland of the toadfish (Opsanus tau L.) is described. The swimbladder is of the euphysoclist type. The gas gland is composed of a single cell layer. Both physiologically and morphologically the swimbladder of the toadfish shows strong resemblances to that of the eel (Anguilla). The swimbladder normally has a high proportion of oxygen, an unusual feature for fishes living in shallow water. (Auth. summ.)

1719. Whitford, L. A. 1958. PHYTOPLANKTON IN NORTH CAROLINA LAKES AND PONDS. Journal of the Elisha Mitchell Scientific Society. Vol. 74, No. 2, pp. 143-157.

Data were obtained largely from net plankton collections made in all types of still waters in the three physiographic provinces of the state over a period of more than ten years. The plankton is Caledonian but three types of floras are recognized.

The Piedmont and Mountain (1) is the most varied with Chrysophyceae and Bacillariophyceae dominant in winter and spring and Chlorophyceae, Dinophyceae, and Cyanophyceae dominant in summer and autumn. The Coastal Plain flora (2) is lower in bulk and has Chrysophyceae, Bacillariophyceae, and Chlorophyceae dominant in winter and early spring with the Chlorophyceae dominant in late spring, summer, and autumn. The brown-water Coastal Plain flora (3) is still lower in bulk, with the Chlorophyceae (desmids) dominant most of the year. A unique feature of this flora is the relative abundance of the diatom Asterionella gracillima in late summer.

Nannoplankton is quite varied as to species but apparently does not equal the euplankton in bulk.

The heavily fertilized farm pond shows a trend toward eutrophication without a change in dominant genera except in summer. Anacystis (Microcystis) cyanea frequently forms summer blooms in fertilized ponds.

There seems to be a correlation between type of flora and hydrogen ion concentration, and with

temperature.

There is a closer correlation between the North Carolina floras and those of other regions similar in geologic conditions than with those of similar climate. (Auth. summ.)

1720. Outten, L. M. 1958. STUDIES OF THE LIFE HISTORY OF THE CYPRINID FISHES NOTROPIS GALACTURUS AND RUBRICROCEUS. Journal of the Elisha Mitchell Scientific Society, Vol. 74, No. 2, pp. 122-134.

Both species occur in the upper Tennessee River system; galacturus is also present in tributaries of the Cumberland, White, and St. Francis rivers and have been taken in the Kanawha, Santee, and Savannah systems. Additional distributional data, as well as synonymy, general behavior, reproduction, age and growth, and food and feeding habits are discussed.

1721. Alikunhi, K. H. 1958. OBSERVATIONS ON FEEDING HABITS OF YOUNG CARP FRY. Indian Journal of Fisheries, Vol. V, No. 1, pp. 95-106.

A series of laboratory experiments on the feeding capacity of carp fry under various environmental conditions were carried out during July-September 1952 and the results indicate the following:

i) The fry avidly feeds on zooplankton and gorges its stomach with them within an hour after commencing feeding. During the same or even a longer period it hardly takes any phytoplankters even if no other food is available in the environment. The fry thus distinguishes desirable from undesirable items of food. Feeding is therefore deliberate and selective. ii) Feeding capacity of the fry appears to be adversely affected by continued starvation. Artificial feeding of fry during temporary storage is therefore considered necessary to keep them healthy and avoid heavy mortality. iii) Feeding capacity is satiated only when the density of fry is low and the concentration of plankton high in the water. iv) At a low concentration of plankton, even when heavily stocked, the young fry are incapable of foraging on all the plankters in the water. v.) With increase in the concentration of plankton the number of plankters consumed in a given time also steadily increases. vi.) Feeding takes place to a limited extent in darkness. This is probably by contact only. (Auth. summ.)

1722. Jones, S., and V. R. Pantulu. 1958. ON SOME LARVAL AND JUVENILE FISHES FROM THE BENGAL AND ORISSA COASTS. Indian Journal of Fisheries, Vol. V, No. 1, pp. 118-143.

The account deals with 16 species of larval and juvenile fishes from the Bengal and Orissa Coasts collected on board M. F. V. Kerala and I. N. S. Investigator. Stages of Zenarchopterus buffoni (Valenciennes), Bregmaceros macclellandi Thompson, Callionymus melanotopterus Bleeker, Psettodes erumei (Bloch and Schneider), Pseudorhombus arsius (Hamilton), P. oligodon (Bleeker), Arnoglossus tapeinosoma Bleeker, Bothus sp., Samaris macrolepis Norman, Solea ovata Richardson. Heteromycteris oculus (Alcock), Cynoglossus spp., Triacanthus brevirostris Temminck and Schlegel, and Parapegasus natans (Linnaeus) are described and figured. Of these the larval and juvenile stages of Zenarchopterus buffoni and Parapegasus natans form connected series and are dealt with in detail. The figure of an adult of the latter is reproduced. Samaris macrolepis which was formerly known only from a single specimen from the Southern Burma Coast is recorded from the Indian Coast for the first time. Early larval stages of Bregmaceros macclellandi are compared with the descriptions of larvae of the above species from the Australian waters and the significant differences are pointed out. (Auth. summ.)

1723. Williams, F. 1958. FISHES OF THE FAMILY CARANGIDAE IN BRITISH EAST AFRICAN WATERS. The Annals and Magazine of Natural History, Vol. 1, No. 6, pp. 370-430.

Thirty species, including one new species, of 12 genera are described. A key to the East African genera is presented.

1724. John, Dora E., and W. W. Brown. 1958. CONTINUOUS PLANKTON RECORDS: LIST OF RECORDS, 1955-1957. Bulletins of Marine Ecology, Vol. 5, No. 40, pp. 44-50.

A continuation of the survey of the North Sea started in 1932 and conducted each year since then with the exception of the years during World War II. Records are presented in tabular form arranged by dates and in chart form showing sampling by months. Nearly all records were obtained by commercial steamships and Ocean Weather Ships during normal operational duties.

1725. Margolis, L. 1958. THE IDENTITY OF THE SPECIES OF LEPEOPHTHEIRUS (COPEPODA) PARASITIC ON PACIFIC SALMON (GENUS ONCORHYNCHUS) AND ATLANTIC SALMON (SALMO SALAR). Canadian Journal of Zoology, Vol. 36, No. 6, pp. 889-892.

A review of existing descriptions of Lepeophtheirus from salmonids, based on specimens collected mainly from Salmo salar in the European and North American Atlantic and from Oncorhynchus spp. in the Asiatic and North American Pacific, coupled with observations by the author on material from S. salar from England and from Oncorhynchus spp. from a wide range of localities in the North Pacific, suggest that L. salmonis (Krøyer, 1838) is the only species found on salmonids from both oceans. The differentiation of L. uenoi Yamaguti, 1939 as a distinct species on Pacific salmon seems to be the result of incorrect or inadequate early descriptions of L. salmonis. (Auth. abst.)

1726. Margolis, L. 1958. A NEW SPECIES OF LECITHOPHYLLUM FROM NORTH PACIFIC

FISHES WITH A CONSIDERATION OF THE TAXONOMY OF THE GENERA LECITHOPHYLLUM, APONURUS, AND BRACHADENA (TREMATODA: HEMIURIDAE). Canadian Journal of Zoology, Vol. 36, No. 6, pp. 893-904.

Lecithophyllum anteroporum n. sp. is described from Merluccius productus from British Columbia waters. Other hosts in the North Pacific are Oncorhynchus nerka and O. gorbuscha. The status of the genera Lecithophyllum Odhner, Aponurus Looss, and Brachadena Linton, and allocation of species within these genera are discussed. Keys to separate the three genera and the four species of Lecithophyllum are presented. Aponurus intermedius Manter is transferred to Lecithophyllum with L. fuscum Yamaguti as a synonym. (Auth. abst.)

1727. Harrington, R. W., Jr., and J. S. Haeger. 1958. PROLONGED NATURAL DEFERMENT OF HATCHING IN KILLIFISH. Science, Vol. 128, No. 3337, p. 1511.

The drying up of flooded lowlands stranded eggs of Fundulus confluentus, which were unhatched and viable after as much as 3 months' exposure. The eggs were found in the moist plant debris on the soil surface. When ovigerous sods were immersed in tap water, normal fish hatched within 15 to 30 minutes. (Auth. abst.)

1728. McFarland, William N. and Kenneth S. Norris. 1958. THE CONTROL OF pH BY BUFFERS IN FISH TRANSPORT. California Fish and Game, Vol. 44, No. 4, pp. 291-310.

Experimental data show that the accumulation of carbon dioxide from respiration may be the primary factor in reduction of the pH of water during transportation of fish. This pH is correlated with mortality of fish in sealed containers during salt water transport. The effects of several buffering compounds upon stabilization of pH in transport waters are reported. One, tris-hydroxymethyl aminomethane, was found to be especially suitable for use during salt water transport. In a closed system experiment the length of time to 50 percent mortality of Fundulus parvipinnis was 2.84 times greater in the most heavily buffered group, as compared to controls. A mathematical model which relates the interactions of metabolism, pH and free CO_2 is developed. It shows that heavy loads of fish in non-buffered water will cause rapid declines in pH. Deaths correlated with pH decline in salt water are assumed to be anoxic and are probably the consequence of the induced Bohr effect. It is suggested that control of carbon dioxide build-up during fish transport may be a major problem in the design of aeration devices.

1729. Yamashita, Daniel T., and Kenneth D. Waldron. 1958. AN ALL-PLASTIC DART-TYPE FISH TAG. California Fish and Game, Vol. 44, No. 4, pp. 311-317.

An all-plastic dart-type fish tag, used with success on skipjack (Katsuwonus pelamis) in Hawaiian waters during 1957, is described. Tagging experiments have resulted in 747 recoveries out of 8,161 releases, and recoveries from individual groups of 3,224 and 2,291 releases equalled 11 and 13 percent respectively. Among the more important advantages of the tag are: (1) small size; (2) simplicity and rapidity of application; (3) low resistance to water flow; and (4) negligible effect on the natural movements of the fish.

1730. Reimers, Norman. 1958. CONDITIONS OF EXISTENCE, GROWTH, AND LONGEVITY OF BROOK TROUT IN A SMALL HIGH-ALTITUDE LAKE OF THE EASTERN SIERRA NEVADA. California Fish and Game, Vol. 44, No. 4, pp. 319-333.

Bunny Lake, a granite basin type located in western Mono County, California, was surveyed and stocked with Salvelinus fontinalis in 1951. Within six years bottom food organisms were reduced to less than one-sixth original numbers. Growth of trout was poor the first year after planting and negligible thereafter. No reproduction of trout occurred. The results of the study indicate that some smaller alpine lakes, once depleted of food, may be difficult to reclaim while trout remain in them. (C. F.)

1731. Wales, J. H. 1958. INTESTINAL FLUKES AS A POSSIBLE CAUSE OF MORTALITY IN WILD TROUT. California Fish and Game, Vol. 44, No. 4, pp. 350-352.

Two cases of mass mortality were investigated; both are believed to have been caused by an intestinal fluke, Crepidostomum. Two intermediate hosts are known, the fingernail clam, Pisidium, and the mayfly nymph, Ephemera. Walls of the intestine of heavily parasitized trout were highly inflamed.

1732. Craig, William L. 1958. THE SHORTNOSE SPEARFISH TETRAPTURUS ANGUSTIROSTRIS TANAKA, A SPECIES NEW TO THE NEAR SHORE FAUNA OF THE EASTERN PACIFIC OCEAN. California Fish and Game, Vol. 44, No 3, pp. 275-280.

On August 31, 1957, a specimen of Tetrapturus angustirostris (1529 mm - 21 3/4 lb.) was taken near the Sixtymile Bank, Baja, California (lat. 32° 05' N., long. 118° 14' W.). This represented an eastward range extension for the species of nearly 1,000 miles and added another genus and species to the pelagic fauna of the temperate west coast of North American. Included are measurements of the fish, and a brief description of the scales which are compared with other eastern Pacific istiophorids. (W. L. C.)

1733. Braun, Edwin L., and Thomas J. Beland. 1958. MENDOCINO NATIONAL FOREST STREAM IMPROVEMENT. California Fish and Game, Vol. 44, No. 3, pp. 261-274.

An investigation of the feasibility of planting streamside vegetation as a method of increasing the

productivity of trout streams was undertaken in Stony Creek Basin in Glenn County, California. Field work began in October, 1951 and continued until October, 1952. The basin had a history of heavy floods, severe fires, and heavy grazing by cattle and deer.

Surveys of natural vegetation indicated that floods were severely damaging to volunteer riparian vegetation, and that the growth of woody plants was in general slow because of the hot, dry summers.

A planting program was undertaken in which cuttings, seeds, and seedlings were used in an effort to find suitable species, sites and methods for establishing streamside cover.

The results clearly indicate that in order for natural streamside vegetation to be significantly augmented, agricultural operations such as fencing, irrigation, and perhaps fertilization are required. (E. L. B.)

1734. Chapman, Donald W. 1958. STUDIES ON THE LIFE HISTORY OF ALSEA RIVER STEELHEAD. Journal of Wildlife Management, Vol. 22, No. 2, pp. 123-134.

Analysis of 978 scale samples from wild adult steelhead (Salmo gairdneri gairdneri Richardson) from this Oregon stream revealed that over 90% remained in fresh water as juveniles for at least two winters. About 52% of all wild fish in the sample had spent two winters in fresh water and were returning to the stream to spawn after two summers of ocean life. Repeat spawners among 1221 wild fish and steelhead of hatchery origin varied by year from about 3 to 17%. Adults of hatchery origin probably constituted less than 10% of the runs in the main-stem Alsea River from 1951 through 1955. The proportion of hatchery fish and of males in a sample of the 1955 adult run decreased as the winter progressed. Condition factors and lengths of 263 adults were tested to determine the effects of sex, origin, location of capture, number of previous spawnings, and age. Analysis of 400 smolt scale samples indicated that 99% had spent at least two winters in tributaries. Adults which had entered the sea at a large smolt size appeared to return at an earlier age to the stream than did adults which entered the sea at a small smolt size. Some hatchery-reared juveniles remained in fresh water over the winter following liberation. About 33% of 243 adults of hatchery origin had spent a winter in the stream after liberation. Rate of downstream movement of wild and hatchery-released smolts appeared to be relatively rapid. It also appeared that smolts spent less than six weeks in the river after formation of the final fresh-water annulus. The downstream migration in 1956 probably reached a peak in mid-May. Smolts were found to move downstream in daylight hours as well as at night. A downstream movement of fish of the year occurred in tributaries. Since none of the adult scales examined showed less than one fresh-water annulus, these fish of the year may remain in the lower river for one or more winters before moving to the sea. It is also possible that they move into the sea immediately and do not survive to adulthood. (Auth. abst.)

1735. Taylor, C. B. 1957. EXTREME SEA WATER TEMPERATURES AND DENSITIES ALONG THE NORTH ATLANTIC STATES DURING SUMMER 1955. Journal of Marine Research, Vol. 16, No. 1, pp. 1-7.

During the summer of 1955, record high sea water temperatures were observed in harbors and coastal waters of the North Atlantic States. Record air temperatures also occurred during this period. It is concluded that high sea water temperatures were due in large part to continued high air temperatures. The record low densities (or salinities) during the same summer corresponded with the periods of hurricanes Connie and Diane, hence the high runoff following these storms was doubtless responsible. The lag between rainfall and noticeable dilution and the delay in return to normalcy depend upon several factors including the amount of rain, type of estuary, and size of drainage basin. (Auth. abst.)

1736. Groves, Gordon W., and Townsend Cromwell. 1957. EXPERIMENTAL INVESTIGATION OF THE EFFECT OF "SECONDARY INSTABILITY" ON MIXING PROCESSES. Journal of Marine Research, Vol. 16, No. 1, pp. 8-11.

Since specific volume in the ocean is a non-linear function of salinity and internal energy, mixing results in a change in the total volume. There is a contribution to the change in potential energy due to mixing, which depends on this change in volume and on the pressure at which mixing takes place. Fofonoff has made use of this fact in defining a "secondary stability" parameter. It might be speculated that, under conditions of (secondary) instability, turbulent mixing could be generated spontaneously or that the quality of mixing would be different from that under stable conditions. An experiment to detect this phenomenon was performed, with negative results. (Auth abst.)

1737. Freeman, John C., Jr., Ledolph Baer, and Glenn H. Jung. 1957. THE BATHYSTROPHIC STORM TIDE. Journal of Marine Research, Vol. 16, No. 1, pp. 12-22.

The tides on a regular open coast change rapidly as a storm approaches, and the time history of this change is important in computing dangerously high tides in bays; in addition, this change influences the maximum wave height offshore. Simple physical assumptions are used (and justified) to define a "bathystrophic" flow, and it is shown mathematically that this flow is of great importance in the computation of storm tides. Using only the traditionally accepted formulae and constants for wind stress and bottom friction, examples of the time change of the tide have been calculated. These results agree with observations as well as can be expected. Deviations from observations may be due to an edge wave. (Auth. abst.)

1738. Spiess, F. N. 1957. ACCELERATION MEASUREMENTS IN THE DEEP OCEAN. Journal of Marine Research, Vol. 16, No. 1, pp. 23-33.

The study of surface waves in the deep ocean can be carried out effectively by using a new technique: measurement of accelerations of a small water mass well below the surface. Instrumentation for carrying out such measurements is described in detail, including a special accelerometer, neutrally buoyant case, long light-weight slack wire, and data-recording equipment. Some initial results achieved with this equipment are shown and the possibility of broader applications of this technique for wave and gravity measurements at sea are discussed briefly. (Auth. abst.)

1739. Stewart, R. W. 1957. A NOTE ON THE DYNAMIC BALANCE IN ESTUARINE CIRCULATION. Journal of Marine Research, Vol. 16, No. 1, pp. 34-39.

Because of the large tidal velocities and small dimensions of estuaries, it is not justified to ignore the effects of the curvature of flow when computing the dynamic balance of the current system. (Auth. abst.)

1740. Yoshida, Kozo, and Han-Lee Mao. 1957. A THEORY OF UPWELLING OF LARGE HORIZONTAL EXTENT. Journal of Marine Research, Vol. 16, No. 1, pp. 40-54.

Based on certain hypotheses, vertical motion in the upper layers is found to be related to the poleward transport in the lower layers. Upwelling off the California coast, based on recent data, is examined; the theoretical result appears to be confirmed by comparison with other independent indications. A new method of locating regions of upwelling with the approximate velocity is proposed. (Auth. abst.)

1741. Glezen, William H. 1957. AN EXTERNAL CORE CATCHER FOR OCEANOGRAPHIC WORK. Journal of Marine Research, Vol. 16, No. 1, pp. 55-59.

A core catcher for use with short gravity-type core barrels is described. A flat plate at the foot of a pair of pivot arms is caused to swing under the bottom of the core barrel after the barrel is withdrawn from the bottom. A float-weight lever arm is employed to actuate the device. (Auth. abst.)

1742. Fuller, John L. 1958. QUANTITATIVE GENETICS OF BEHAVIORAL ATTRIBUTES. Biometrics, Vol. 14, No. 1, pp. 134-135.

The heritability of behavioral attributes has often been demonstrated by selection experiments and comparisons between pure lines. Usually it is concluded that differences in these characters depend upon numerous genes. However, many authors have attempted to explain their results on the basis of a few genes. This paper describes attempts to fit data on activity, learning, and emotionality in animals to various genetic models. Problems of scaling are often encountered, since behavior does not have natural units of measurement such as grams or centimeters. Interaction between genes also leads to complexity. Hybrids may fall outside the parental range. In spite of these difficulties it is concluded that quantitative genetics models can be applied to metrical behavioral characters just as they can be used to analyze the inheritance of structure. (Auth. abst.)

1743. Hoar, William S. 1958. EFFECTS OF SYNTHETIC THYROXINE AND GONADAL STEROIDS ON THE METABOLISM OF GOLDFISH. Canadian Journal of Zoology, Vol. 36, No. 2, pp. 113-121.

Studies of both standard and active metabolism agree with most previous findings that thyroid hormone lacks a calorigenic effect while the gonadal steroids stimulate oxygen consumption. Thyroxine, testosterone, or stilboestrol will produce a marked increase in the excretion of nitrogen as measured by changes in the ammonia of the ambient water. (Auth. abst.)

1744. Lawler, G. H. 1958. VARIATION IN NUMBER OF DORSAL SPINES IN THE BROOK STICKLEBACK, EUCALIA INCONSTANS. Canadian Journal of Zoology, Vol. 36, No. 2, pp. 127-129.

The brook stickleback, Eucalia inconstans (Kirtland) is usually described as possessing five or six dorsal spines and the species is commonly called the five-spine stickleback. In Heming Lake, Manitoba, fish with six dorsal spines predominate. The occurrence of sticklebacks with a high number of dorsal spines is noted from other Manitoba lakes and to a lesser extent in samples from some Ontario lakes. Indications are that the dorsal spines are more numerous in fish from the Hudson Bay drainage than from the Great Lakes region. An increase in the number of dorsal spines with increasing latitude is apparent. (Auth. abst.)

1745. Laird, Marshall. PARASITES OF SOUTH PACIFIC FISHES. I. INTRODUCTION, AND HAEMATOZOA. Canadian Journal of Zoology, Vol. 36, No. 2, pp. 153-165.

During 1952-54, fishes were collected and examined for parasites (particularly those of the blood and gills) at various localities ranging from Sydney, Australia, through the island groups of Melanesia to Tarawa, Gilbert and Ellice Islands Colony. Most of the specimens were obtained by poisoning intertidal zone pools on coral reefs or rocky coasts, the remainder being from freshwater or brackish sources. A total of 1121 fishes of at least 122 species, 63 genera, and 27 families were dealt with. This paper, the first of a series detailing the findings, includes a complete list of the material, an account of the techniques employed, and new host and locality records for Haemogregarina bigemina Laveran and Mesnil and H. mugili Carini. (Auth. abst.)

1746. Laird, Marshall. 1958. PARASITES OF SOUTH PACIFIC FISHES. II. DIPLECTANUM MELANESIENSIS N, SP., A MONOGENETIC TREMATODE FROM FIJI AND THE NEW HEBRIDES. Canadian Journal of Zoology, Vol. 36, No. 2, pp. 167-173.

Thirty-six immature examples of the serranid Epinephelus merra Bloch were collected from coral pools at Aneityum (New Hebrides) and Makuluva Islet (Fiji), on four occasions from 1952 to 1954. The gills of all of them were infected with Diplectanum melanesiensis n. sp., the closest known relatives of which parasitize allied hosts in Japan (D. epinepheli Yamaguti) and Celebes (D. serrani Yamaguti). The South Pacific species resembles D. serrani but differs from D. epinepheli in lacking a conspicuous ejaculatory bulb and in having a transversely positioned ovary the elongate terminal portion of which enfolds the right caecum. It is distinguished from both these species by its markedly smaller size (217 to 500 μ by 66 to 117 μ, av., 366 by 92 μ) and the structure of the squamodiscs, which have nine concentric rows of rodlets, the four innermost ones forming complete circlets. (Auth. abst.)

1747. Burdick, G. E., Howard J. Dean, and Earl J. Harris. 1958. TOXICITY OF CYANIDE TO BROWN TROUT AND SMALLMOUTH BASS. New York Fish and Game Journal, Vol. 5, No. 2, pp. 133-163.

Toxicity curves for cyanide are established for brown trout and smallmouth bass at 60° and 70° F., respectively, through plotting mean time to death against concentration. A constant-flow, constant-temperature device was used in the procedure and is described. A comparison is made between the toxicity of cyanide in a soft, acid water and that in a water of median alkalinity for this State. Methods of reduction of oxygen are compared preliminary to establishing toxicity curves at reduced oxygen comparable to the "standards" established by the Water Pollution Control Law of this State.

A threshold value for toxicity is approximated for each of these curves by the graphical method previously described by the senior author, and the method is used to compute the equation of the curve. (Auth. abst.)

1748. Zilliox, Robert G., and William D. Youngs. 1958. FURTHER STUDIES ON THE SMELT OF LAKE CHAMPLAIN. New York Fish and Game Journal, Vol. 5, No. 2, pp. 164-174.

Studies were conducted during February and March in 1948 and 1950 to determine the status of the smelt fishery in Lake Champlain. Data were available for comparative purposes from a detailed study conducted during a similar period in 1929. Fishing is often conducted over a 24-hour period. Night fishing is prevalent in the Port Henry area, and lights are used to illuminate the depths.

Sampling of the night catch indicated night fishing was no more selective for female fish than was day fishing; nor were older-aged female smelt particularly more numerous in the night sample than in the day sample.

Two major races of smelt inhabit Lake Champlain and are referred to as the small race and the large race. The small race was found to be less numerous in the 1948 and 1950 samples than in the 1929 sample. Growth data are compared for samples of the large race collected in 1929 and 1950. The growth of males and females, in the 1950 sample, showed no significant difference between mean lengths for three of the five age classes tested. Similar tests for the 1929 males versus 1950 males, and the 1929 females versus 1950 females, showed no significant difference for 8 of the 10 comparisons made. Angler interviews revealed an equally divided opinion as to a declining fishery. Successful smelt angling was found to be dependent upon safe ice conditions. No need was seen for restrictive changes in fishing regulations at that time. (Auth. abst.)

1749. Haskell, David C., and Richard O. Davies. 1958. CARBON DIOXIDE AS A LIMITING FACTOR IN TROUT TRANSPORTATION. New York Fish and Game Journal, Vol. 5, No. 2, pp. 175-183.

Carbon dioxide accumulation is shown to be a major limiting factor in fish transportation in tanks; high concentrations will be tolerated if the rate of build-up is slow, but, when the rate of increase is high, as with heavy loads, the fish will become distressed. Carbon dioxide may be removed by passing large volumes of oxygen or compressed air through the water; by bailing the water continuously; by recirculation and aeration; by the additon of chemicals, the latter at least under close experimental control. With effective control of carbon dioxide by recirculation and aeration, loads may be increased by the addition of oxygen sufficient to maintain a minimum of 10 p.p.m. (Auth. abst.)

1750. Youngs, William D. 1958. EFFECT OF THE MANDIBLE RING TAG ON GROWTH AND CONDITION OF FISH. New York Fish and Game Journal, Vol. 5, No. 2, pp. 184-204.

The effect of mandible ring tags on length and condition of fish was studied for five species, namely, smallmouth bass, landlocked salmon, brook trout, brown trout, and rainbow trout. Length and condition were compared in ten instances. Length increments of tagged and untagged fish were significantly different in seven instances, and condition was significantly different in one instance. Mandible ring tags caused no additional mortality in rainbow trout. For the other species, samples were not suitable for calculating mortality. (Auth. abst.)

1751. Hartman, Wilbur L. 1958. ESTIMATION OF CATCH AND RELATED STATISTICS OF THE STREAM RAINBOW TROUT FISHERY OF THE FINGER LAKES REGION. New York Fish and Game Journal, Vol. 5, No. 2, pp. 205-212.

A creel census was conducted during the opening

week of stream fishing for rainbow trout in the Finger Lakes region in 1955, 1956, and 1957. Estimates of total catch and related statistics were derived from the collected data.

Catches ranged from 140 trout in 1957 at Cold Brook (Keuka Lake inlet) to 980 in 1955 at Catherine Creek (Seneca Lake inlet). More fish were caught opening day than on any succeeding day.

Opening-day fishing pressure at Catherine Creek ranged from 360 to 640 anglers per mile of stream. It was considerably less at the other streams.

Of the 19,646 anglers contacted in the three years, only 1,652 (8.4 percent) caught fish. Highest fishing success occurred at Grout Brook (Skaneateles Lake inlet); lowest at Catherine Creek.

Data on the distribution of fish among successful fishermen permitted an evaluation of the present creel limit of five fish. It did not function in restricting the catch. If it is found desirable in the future limit exploitation of the rainbow trout spawning runs, the creel limit would not become an effective means until reduced to two fish. (Auth. abst.)

1752. Slastenenko, E. P. 1958. THE DISTRIBUTION OF FRESHWATER FISHES IN THE PROVINCES AND THE MAIN WATER BASINS OF CANADA. Bulletin of the Shevchenko Scientific Society, Vol. 1, No. 6, 11 pgs.

A table gives the comparative distribution of the fresh water fishes of Canada showing the number of species for each province and the main water basins, such as the Great Lakes, and the Canadian waters of Atlantic, Arctic and Pacific oceans. The total number of kinds of fishes of Canada, 187 species and subspecies have been given consideration. These belong to 13 orders, 27 families, and 87 genera.

1753. Ross, Robert D. 1958. RACES OF THE CYPRINID FISH, CAMPOSTOMA ANOMALUM PULLUM (AGASSIZ) IN EASTERN UNITED STATES. Virginia Polytechnic Institute, Department of Biology Technical Bulletin 136, 20 pgs.

There are at least four races of C. a. pullum in eastern United States, which are named for the streams they occupy: the Upper Allegheny River Race, Upper Genesee River Race, Upper Susquehanna River Race, and Upper Fall Creek Subrace, the latter a small stream tributary to Lake Cayuga in Tompkins County, New York. These four races have differentiated from each other on the racial level in a majority of ten scale characters. Subspecific differences are noted among the races, but subspecific recognition is withheld because this and other subspecies of Campostoma anomalum are extremely variable, with numerous local races.

The origins of the Upper Allegheny River Race is obscure, but the writer favors a pre-Pleistocene theory, which assumes that ancestors of C. a. pullum once existed in the Old Upper Allegheny River. Late Pleistocene glacial drainage changes then made it possible for upper Allegheny River campostomids to cross present divides, successively at Cuba and at Canisteo, whereby these minnows and others gained access to the Genesee and Susquehanna Rivers. Introduction into Fall Creek occurred in Lake Newberry time, when central New York drainage was to the south via the Susquehanna River.

While these forms do not represent full subspecies, in some characters they have differentiated to this level. Radio carbon dating techniques estimate the interval of time for this evolution to have been from 10,000 to 11,000 years. (Auth. summ.)

1754. Murray, A. R. 1958. SURVIVAL AND UTILIZATION OF ATLANTIC SALMON OF THE LITTLE CODROY RIVER, NEWFOUNDLAND. Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations, No. 70, pp. 16-21.

For the three years 1954, 1955, and 1956, seaward migrating smolts were finclipped as they passed the counting weir and recaptured as they returned. Two things became evident, that 70 percent of the adults of each sea age recorded at the weir were in their natal stream, and that very few smolts, less than 1 percent, survive to return to their natal stream.

Information on the recovery of finclipped salmon in the commercial fishery was also obtained. For the years 1955, 1956, and 1957 finclipped salmon comprised 1/5 to 2/5 of the total catch of the fishery near the mouth of the natal stream and about .07 to .23 percent of the total "Newfoundland" landings.

Actual total return (survival) for 1954 smolts was 1.7 percent, the probable total return, 3.3 percent; for 1955 smolt returns were 1.5 percent actual and 3.3 percent probable. In each year, 1/3 was recorded at the weir and 2/3 was taken in the commercial fishery. On the basis of probable return each year, 1.5 percent of the smolt return as grilse and 1.7 percent return as small salmon, very few as large salmon. Males formed 82 percent of the grilse, 55 percent of the small salmon, and only 17 percent of the large salmon. This indicates that most of the female fish are taken by the fishery.

1755. Gerking, Shelby D. 1957. EVIDENCE OF AGING IN NATURAL POPULATIONS OF FISHES. Gerontologia, Vol. 1, No. 5, pp. 287-305.

Fishes can be aged from structural modification of the scales and certain other hard parts of their bodies which are associated with seasonal growth. From this information the age composition and survivorship curves of populations can be determined. Unexploited species exhibit an increasing rate of mortality with increasing age which is one of the major criteria used to detect senescence. This characteristic has been found in the whitefish, lake trout, sauger, arctic whitefish, and tullibee. These are long-lived species which live in deep, freshwater lakes where they are protected from extreme changes in the environment. A shallow water species, the rock bass and one Pacific ocean fish, the herring,

also have an increased mortality as they grow older.

Evidence has been slowly accumulating that certain bony fishes senesce as do other vertebrates. The efficiency of protein utilization for growth declines as fish grow older just as it does in other animals. Gradual loss of reproductive capacity, changes in the histology of the gonads and other organs, and the fact that males usually mature earlier and die more quickly than females are directly comparable to aging changes in mammals. High mortality rates are associated with high growth rates in nature.

This point of view is directly opposed to Bidder's theory that vertebrate senescence is a correlate of the evolution of determinate growth and of a final absolute size. Our information fits more closely with the idea of Pearl that factors which retard growth or reduce metabolism tend to postpone senescence. Fishes may be exceptionally good material to test this hypothesis. (Auth. summ.)

1756. Snieszko, S. F. and Ken Wolf. 1958. INFECTIOUS PANCREATIC NECROSIS OF SALMONID FISHES. U. S. Fish and Wildlife Service Fishery Leaflet 453, 3 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence and methods of control are discussed. An annotated bibliography is provided.

1757. Wolf, Ken. 1958. VIRUS DISEASE OF SOCKEYE SALMON. U. S. Fish and Wildlife Service Fishery Leaflet 454, 3 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1758. Wolf, Ken. 1958. BLUE-SAC DISEASE OF FISH. U. S. Fish and Wildlife Service Fishery Leaflet 455, 3 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1759. Wolf, Ken. 1958. WHITE-SPOT DISEASE OF FISH EGGS AND FRY. U. S. Fish and Wildlife Service Fishery Leaflet 456, 2 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1760. Wolf, Ken. 1958. SOFT-EGG DISEASE OF FISHES. U. S. Fish and Wildlife Service Fishery Leaflet 457, 2 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1761. Wolf, Ken. 1958. LYMPHOCYSTIS DISEASE OF FISH. U. S. Fish and Wildlife Service Fishery Leaflet 458, 4 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1762. Snieszko, S. F. 1958. FRESHWATER FISH DISEASES CAUSED BY BACTERIA BELONGING TO THE GENERA AEROMONAS AND PSEUDOMONAS. U. S. Fish and Wildlife Service Fishery Leaflet 459, 6 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1763. Wolf, Ken 1958. FUNGUS OR SAPROLEGNIA INFESTATION OF INCUBATING FISH EGGS. U. S. Fish and Wildlife Service Fishery Leaflet 460, 4 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence and methods of control are discussed. An annotated bibliography is provided.

1764. Snieszko, S. F. 1958. COLUMNARIS DISEASE OF FISHES. U. S. Fish and Wildlife Service Fishery Leaflet 461, 3 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence and methods of control are discussed. An annotated bibliography is provided.

1765. Snieszko, S. F. 1958. FIN ROT AND PEDUNCLE DISEASE OF SALMONID FISHES. U. S. Fish and Wildlife Service Fishery Leaflet 462, 2 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1766. Snieszko, S. F. 1958. NUTRITIONAL

(DIETARY) GILL DISEASE. U. S. Fish and Wildlife Service Fishery Leaflet 463, 2 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1767. Snieszko, S. F. 1958. BACTERIAL GILL DISEASE OF FRESH-WATER FISHES. U. S. Fish and Wildlife Service Fishery Leaflet 464, 4 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1768. Wolf, Ken. 1958. KIDNEY DISEASE OF SALMONID FISHES. U. S. Fish and Wildlife Service Fishery Leaflet 465, 4 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1769. Piper, Robert G. 1958. ULCER DISEASE IN TROUT. U. S. Fish and Wildlife Service Fishery Leaflet 466, 3 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1770. Snieszko, S. F. 1958. FISH FURUNCULOSIS. U. S. Fish and Wildlife Service Fishery Leaflet 467, 4 pgs.

Identification, cause of the disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence, and methods of control are discussed. An annotated bibliography is provided.

1771. Chipman, Walter A., Theodore R. Rice, and Thomas J. Price. 1958. UPTAKE AND ACCUMULATION OF RADIOACTIVE ZINC BY MARINE PLANKTON, FISH, AND SHELLFISH. U. S. Fish and Wildlife Service Fishery Bulletin 135, pp. 279-292.

Zinc concentrations in sea water and in shellfish samples, collected from inshore waters along the Atlantic and Gulf of Mexico coasts are reported. Oysters, clams, and scallops concentrate large amounts of this trace metal, the oysters containing the greatest amounts. Radioactive zinc added to the water was rapidly taken up in great amounts by shellfish. Considerable accumulation of the nuclide takes place in the gills of these mollusks, with high concentrations in the kidneys of scallops, and considerable amounts in the hepatopancreas.

Nitzschia closterium, a marine phytoplankton took up large amounts of zinc 65 and apparently concentrates zinc, thus allowing its transfer to marine animals. Marine fish quickly take zinc into the body from the digestive tract. Much of the incoming zinc appears to be excreted rather promptly. A rapid uptake of radioactive zinc from an oral dose took place in the kidney, liver, and other internal organs, but the loss of the nuclide was also rapid. A slow and long-continued accumulation took place in bone, integument, and muscle tissues. Although there was immediate loss of contained radioactive zinc when marine fish were returned to flowing sea water, a small percentage remained with only very slight loss over many days. (Auth. abst.)

1772. Anon. 1958. PROGRESS REPORT ON ALASKA FISHERIES MANAGEMENT AND RESEARCH, 1957. U. S. Fish and Wildlife Service Special Scientific Report-Fisheries No. 258, 22 pgs.

The Bureau of Commercial Fisheries of the U. S. Fish and Wildlife Service operates in Alaska under the general authority provided in the Congressional Act of June 18, 1926, commonly called the White Act. In accordance with the purposes outlined in this Act, the administration of the commercial fisheries of Alaska has three principal functions: (1) To investigate the status of the fisheries resources and determine by scientific means whether they are yielding the maximum harvest and, if they are not, how this might be done; (2) to translate the scientific findings into management measures and regulations in order to achieve the maximum sustained yield; and (3) to enforce the fishery laws and regulations established by the Secretary of the Interior. This report provides a brief description of the trends in the major Alaskan fisheries and the preliminary results of the research being done.

1773. Cope, Oliver B. 1958. ANNOTATED BIBLIOGRAPHY ON THE CUTTHROAT TROUT. U. S. Fish and Wildlife Service Fishery Bulletin 140, pp. 417-442.

Publication of articles on the cutthroat trout began before the turn of the century, after explorations in the Intermountain Region had brought several forms of the cutthroat to the attention of fishery workers. The present compilation brings together 135 abstracts of papers which deal with the biology, culture, distribution, and management of the cutthroat. Twenty-seven zoological names proposed for the cutthroats are listed, and 70 vernacular names, taken from the literature, are presented. (Auth. abst.)

1774. Hasler, Arthur D. 1957. NATURAL AND ARTIFICIALLY (AIR-PLOWING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS

FROM THE MUDS OF LAKES. International Conference on Radioisotopes in Scientific Research, UNESCO, Vol. IV, Paris, 1957, 16 pgs.

Lakes are wasteful of the phosphorus entering them. Therefore intrafertilization procedures hold promise toward increasing the production of fish. In an undisturbed mud-water system, the percentage, as well as the amount of phosphorus which is released to the superimposed water is very small. When P^{32} is placed at various depths in the mud the diffusion into the overlying non-circulating water is negligible if placed greater than 1 cm in the mud.

Application of lime to the water, or to the mud, reduces the amount of soluble phosphorus available. Acidification of previously alkalized mud will, upon agitation, increase the amount of phosphorus entering solution.

In an aquarium experiment, circulation of the water above phosphorus-rich mud with the aid of air bubbles increases the phosphorus in solution.

Synthetic circulation of thermally stratified lakes by compressed air bubbles for the purpose of fertilizing the surface water will be discussed. An example will be illustrated where a small lake was completely aerated with an effort of 2.4 horsepower hours per kg of O_2 added.

Lakes as experimental models for oceanographic and isotope studies will be discussed. (Auth. abst.)

1775. Mansueti, Romeo. 1958. EGGS, LARVAE AND YOUNG OF THE STRIPED BASS, ROCCUS SAXATILIS. Maryland Department of Research and Education, Contribution Number 112, 35 pgs.

Detailed descriptions of the early development of the striped bass, Roccus saxatilis (Walbaum), with emphasis on variation in size and morphology, sequence of fin formation, changes in body form, and attainment of the full complement of meristic numbers, are presented and illustrated for the first time. The egg is spherical, transparent, nonadhesive and relatively large. It is pelagic and buoyant, although it sinks in quiet fresh water. When unfertilized, it averages 1.3 mm. in diameter, but is 3.4 mm. when fertilized and water-hardened. The granular yolk sac, green when alive and whitish-yellow when preserved, averages 1.2 mm., and the single amber-colored oil globule is about 0.6 mm. in diameter.

Newly hatched striped bass prolarvae, which range from 2.9-3.7 mm. in total length, are relatively undeveloped and nearly transparent, with no mouth opening, unpigmented eyes, and a greatly enlarged yolk sac with the large oil globule projecting beyond the head. When 5-6 mm. long the yolk sac and oil globule are assimilated and the postlarvae show advanced development of the internal anatomy. Although the fish is still transparent, scattered melanophores are found on the head and body and chromatophores in the eyes and the ventro-posterior edge of the body.

Postlarvae transform to young between 7 and 10 mm. in length when the finfolds are lost except in the dorsal, anal and caudal regions. The largest fish in this group possess well formed skeletons with full complements of 25 vertebrae. Between 10 and 20 mm. in length all fish are fully transformed, muscular tissue renders most of the internal structure obscure, and the myotomes, which generally correspond in number with the vertebrae, are no longer visible. At fish lengths of 20-30 mm. scales are found on all specimens, and with the exception of the pectoral fin-rays, a full complement of meristic structures is present in all other fins. At this stage the body is pigmented uniformly with small spots. Linear regressions between several dependent variables and the independent variable of standard length indicate that the rate of development of head, eye, and snout to anus lengths is proportional to the length of the larvae and young. Body depth and standard length are non-linear among newly-hatched larvae.

Hatchery-reared striped bass demonstrated a slow rate of growth, and were regarded as "stunted," when compared to growth rates observed in another study and field collections. Observations were also made on abnormal eggs and teratological larvae and young. Blue-sac disease is tentatively identified and described for the first time in larvae and pugnosed larvae and young are also described for the first time in striped bass. (Auth. abst.)

1776. Mansueti, Romeo. 1958 THE DEVELOPMENT OF ANAL SPINES AND SOFT-RAYS IN YOUNG STRIPED BASS, ROCCUS SAXATILIS. Maryland Department of Research and Education, Contribution Number 113, 12 pgs.

The process on anal spine formation from a soft-ray of the anal fin is described and illustrated for the first time, based on a study of 151 recently transformed striped bass, Roccus saxatilis (Walbaum). A qualitative and statistical analysis of the anal fin-rays showed that the third anal spine develops from the first terminally segmented soft-ray. The latter loses its segmentations, becomes ossified and fuses into a typical spine.

Anal spine formation in the fish, ranging from 5-55 mm. in total length, showed that: (a) fish with one and two anal spines and usually 12 soft-rays are the smallest, ranging from 10-35 mm., and of this group, none under 20 mm. possess three anal spines; while (b) fish with three anal spines and usually 11 soft-rays are largest, ranging from 20-55 mm., and of these, fish over 35 mm. in length have three fully developed anal spines. (Auth. abst.)

1777. Tanonaka, George. 1957. AGE, LENGTH, AND BODY WEIGHT OF SALMON CAUGHT BY JAPANESE HIGH-SEAS FLEETS IN NORTH PACIFIC. U. S. Fish and Wildlife Service, Special Scientific Report-Fisheries No. 259, 10 pgs.

Data on the age composition of red salmon caught by the Japanese high-seas salmon fleets indicate the dominance of 2-year-in-ocean reds in the even years and 3-year-in-ocean reds in the odd years.

The majority of the 3-year-in-ocean reds are

sexually mature. Some of the 2-year-in-ocean red salmon are mature fish but the proportion of mature and immature cannot be assigned at this time. More than 75 percent of the 1957 catch of red salmon were mature fish.

The majority of the 5-year-old chum salmon are sexually mature, while the 4-year-olds represent both immature and mature fish. In 1955 the majority of the chum salmon taken by this fishery were 4 years old; a significant number were immature. In 1956 the majority of the chum salmon were 5 years old and mostly mature.

The pink salmon available to the fishery were all mature fish. (Auth. abst.)

1778. Yamashita, Daniel T. 1958. ANALYSIS OF CATCH STATISTICS OF THE HAWAIIAN SKIPJACK FISHERY. U. S. Fish and Wildlife Service Fishery Bulletin 134, pgs. 253-278.

The catch statistics of the Hawaiian skipjack fishery and its associated live-bait fishery for the period 1900 through 1953 are brought together from all available records.

The various facets of the live-bait fishery, the only important one in the central Pacific, the methods of data collection for the skipjack and live-bait fisheries, and the completeness and accuracy of the catch records, are analyzed. Skipjack records in terms of weight caught were nearly complete for 1945 through 1953, as an estimated 94 percent of the catch was reported compared with an estimate of only two-thirds to three-fourths of the catch in earlier records. The bait-catch records for 1946 through 1953 were approximately 75 percent complete.

A description of the 1953 fishing fleet and the essential specifications of the sampans in the Territory of Hawaii, information which may be useful in evaluating future changes in catch per unit of effort, are presented. (Auth. abst.)

1779. Strasburg, Donald W. 1958. DISTRIBUTION, ABUNDANCE, AND HABITS OF PELAGIC SHARKS IN THE CENTRAL PACIFIC OCEAN. U. S. Fish and Wildlife Service Fishery Bulletin 138, pp. 335-361.

The distribution and abundance of the central Pacific pelagic sharks was investigated by longline fishing mehtods during 1952-55. In this period more than 6,000 sharks were caught; these belonged to 12 species. Great blue, whitetip, and silky sharks predominated. Bonito, thresher, mackerel, and other species were uncommon or rare.

Several significant facets of the biology of the common sharks were evident. The wide-ranging great blue shark made pronounced seasonal migrations during which sexual segregation occurred and reproduction probably took place. Vertical distribution of the great blue shark was limited in the north by the 45°-69°F. isotherms, and it was truly an oceanic species. The whitetip and silky sharks were denizens of the Tropics, and showed no particular migratory tendencies; the former was oceanic but the latter tended to be neritic.

In equatorial waters, great blues and whitetips were more abundant in warm years, and the silky more abundant in cold years. The species considered here fed principally on small fish and squid. The great blue shark was virtually harmless to the tuna catch. Only 1 percent of the catch was damaged where it abounded, as compared with 20 percent damaged in regions where the whitetip and silky sharks were dominant. In the great blue shark both the behavioral and geographical types of sexual segregation were found, and sexual segregation itself was related to latitude, shark length, and season. (Auth. abst.)

1780. Ahlstrom, Elbert H., and Robert C. Counts. 1958. DEVELOPMENT AND DISTRIBUTION OF VINCIGUERRIA LECETIA AND RELATED SPECIES IN THE EASTERN PACIFIC. U. S. Fish and Wildlife Service Fishery Bulletin 139, pp. 363-416.

Vinciguerria lucetia, family Gonostomatidae, is one of the most abundant pelagic fishes in the eastern North Pacific between the Equator and about 35°N. latitude. It is an important forage fish.

Development is described from the embryonic to the adult stage. The spherical pelagic eggs are moderately small (0.59-0.74 mm.), lack an oil globule, have a segmented yolk and a double shell membrane. The larvae resemble those of the Pacific sardine. The marked metamorphosis has been divided into three stages: prometamorphic, midmetamorphic, and postmetamorphic. Ossification of the vertebral column occurs immediately before metamorphosis. The caudal, dorsal, and anal fins form during the larval period, but procurrent caudal-ray formation is not completed until metamorphosis. Rays do not form in either the pectoral or ventral fins until metamorphosis.

Photophores develop during metamorphosis, at first as white photophores (prometamorphic stage), then as pigmented functional organs. Six or seven pairs of photophores form late, during the midmetamorphic and postmetamorphic stages. Photophore formation is completed and all photophores are pigmented by the end of metamorphosis.

Development is traced from larva to adult for changes in body form, in pigmentation, in sequence of formation of teeth, gill rakers, and other structures.

Distribution of the larvae of Vinciguerria lucetia within the area surveyed by cruises of the California Cooperative Oceanic Fisheries Investigations is shown for 2 years, 1951 and 1952. Larvae increase in abundance from southern California to southern Baja California; they are taken throughout the year. The wider distribution in the eastern Pacific, between 14°S. latitude and 35°N. latitude is illustrated, and variation in photophore number with latitude is pointed up. The range in mean number of photophores per side in different localities was from 78.50 to 83.40.

Two other species of Vinciguerria occur in the eastern Pacific: V. nimbaria and V. poweriae. Both occur on the fringes of the area routinely surveyed on CCOFI cruises. Characters used to separate the three species at different stages of

development are given. (Auth. abst.)

1781. El-Zarka, Salah El-Din. 1958. FLUCTUATIONS OF THE YELLOW PERCH POPULATION IN SAGINAW BAY. Dissertation Abstracts, Vol. XVIII, No. 5, p. 1904.

The average annual commercial production of Saginaw Bay yellow perch dropped from 1,961,309 pounds in 1891-1916 to 499,938 pounds in 1917-1955. Since 1938 (1939-1955), the catch has been below 500,000 except in 1943, 1944, and 1955. The small catches of 1939-1955 do not reflect scarcity of yellow perch. The catch of legal-sized fish per unit of effort has tended to increase sharply.

This thesis is built around two major themes: comparison of perch collected in 1929-1930 (as reported in an earlier publication) and 1943-1955 as to growth rate, age composition, size distribution, length-weight relation, sex ratio; description and inquiry into factors of fluctuations in the strength of the year classes 1939-1952 and in growth rate in 1942-1954.

Age determination and growth calculation were based on the scales of 4,285 fish, 3,407 of them collected during the spawning seasons of 1943-1955 and the remainder at other seasons in 1955. The average age of fish in trap-net samples collected in the spring increased between 1929-1930 (3.8 years) and 1943-1955 (4.3 years), and growth declined sharply. Saginaw Bay yellow perch of the 1929-1930 samples reached legal length (8 1/2 inches) in 3 years but those taken in 1943-1955 required more than 5 years to attain the same size. At the same time the modal length dropped from 8.5-8.9 to 6.5-6.9 inches and the percentage of legal-sized fish from 74 to 11 percent. In both periods, the females averaged larger than the males and grew more rapidly.

The growth in length and weight of Saginaw Bay yellow perch in 1943-1955 was the slowest yet reported from any Great Lakes waters. The decrease in growth rate in Saginaw Bay was believed to have resulted from a more than sevenfold increase in the population density. A "space factor" rather than competition for food may account for the decline in growth rate. Fish of the 1943-1955 samples gave no evidence of a scarcity of food; on the contrary, they were heavier for their length than fish caught in 1929-1930.

The weight of yellow perch in the 1943-1955 samples increased as the 3.262 power of the length. Seasonal changes in the length-weight relation were small. Females lost 12.3 percent of their weight at spawning.

Males were relatively more plentiful in 1943-1955 (62 percent) than in 1929-1930 (25 percent). The percentage of males decreased with increase of age in 1929-1930 but increased in 1943-1955.

Both males and females attained sexual maturity at a small size (nearly all males were mature at 5.0-7.5 inches; 80 percent of females at 7.0-7.4 inches). The present size limit of 8 1/2 inches is greater than is needed to protect immature fish.

The strongest year classes were those of 1939 and 1952. The weakest were those of 1941 and 1945. Year-class strength was correlated significantly with production 4, 5, and 6 years later, but it was not correlated with the abundance of legal-sized fish in the year of hatching or with temperature, precipitation, water level, and turbidity.

The annual fluctuation of growth in length in the first and in later years of life were dissimilar. First-year growth was poorest in 1942 but tended strongly to improve in subsequent years. First-year growth was correlated negatively with turbidity in June and July but was not correlated with year-class strength or other factors investigated. Fluctuations of growth in later years of life were largely without trend. Growth in these years was not correlated with the abundance of legal-sized fish, temperature, precipitation or turbidity, but varied inversely with the water level for May to October. (Auth. abst.)

1782. Latta, William Carl. 1958. THE ECOLOGY OF THE SMALLMOUTH BASS, MICROPTERUS D. DOLOMIEUI LACÉPÈDE, AT WAUGOSHANCE POINT, LAKE MICHIGAN. Dissertation Abstracts, Vol. XVIII, No. 5, p. 1905.

This is a study of reproduction, growth, movement, mortality rates and numerical abundance of the smallmouth bass at Waugoshance Point, Lake Michigan, 1953 through 1955. Basic data are provided for comparison with other smallmouth bass populations in Michigan's Great Lakes for the formulation of a management plan.

Male bass matured at a total length of about 10 inches, females at about 12.5 inches. Nesting began when water temperatures rose from the fifties to the sixties (°F.). Although common shiners (Notropis cornutus) spawned in bass nests, they were not detrimental. Carp (Cyprinus carpio) destroyed nests in a limited area only, where much silt and detritus overlaid the gravel. Fishermen were not harmful to nests. During the spring of 1955, water temperatures falling to the fifties (°F.) after nesting had begun caused male bass to desert many nests. The eggs were removed by some predator. Discounting temperature-related loss of nests in 1955, there was still a nest mortality of 46 percent. Likewise, in 1954, a year in which temperatures during spawning time were stable, there was a 45 percent loss. Predation seemed to be the most likely cause of this loss of nests.

Age of the smallmouth bass was determined from the scales. Validity of the annulus was verified by recoveries of tagged fish. The annulus was formed each year in the period from mid-June through the third week in July. The body-scale relationship was established; growth for previous years of life was calculated. Fish from Waugoshance were growing faster than those from the Lake Ontario-St. Lawrence River region, equal to those from Cayuga Lake, New York, and slower than the bass from inland waters of Wisconsin. The numbers of

fish in the 1947 and 1949 year-classes were exceptionally large. The length-weight relationship of the bass was found to be log W=-5.39796 + 3.35611 log L. Coefficients on condition (K) were higher than K values from the inland waters of Michigan and Wisconsin.

A tag was fastened on the left side of the upper jaw of each of 1,058 bass in 1953, 1,819 in 1954, and 264 in 1955. Loss of tags was estimated on the basis of recoveries of 1953 fin-clipped fish without tags. Neither the jaw tag nor clipped fin caused excessive mortality. Analyses of tag returns from nets and anglers showed little movement of bass either to, or away from Waugoshance Point. Among the 1954 tagged bass, with an increase in size, there was an increase in distance travelled and an increase in the number of times a fish was captured in a net. In early 1954, fin-clipping and tagging were alternated in marking a group of bass captured in the nets. Anglers caught tagged bass as readily as fin-clipped ones. Tagged bass showed the same pattern of movement as fin-clipped bass.

Estimates of the numerical abundance of bass 10 inches or longer were made, using the mark-and-recapture (Petersen) method. The size of the population in the spring of 1954, estimated with trap-net recoveries, was 6,007 bass; using angler returns the estimate was 5,264 bass. In 1955, the same procedures indicated populations of 4,920 and 4,184 bass, respectively. Total mortality rate for 1954, using mark and recapture of fish in two successive years, was 0.58. During 1954, from an estimated harvest, a fishing mortality rate of 0.22 was calculated. Natural mortality was 0.36. The anglers harvested an estimated 1,996 bass during the fishing season. (Auth. abst.)

*1783. Breder, C. M., Jr. 1957. MINIATURE CIRCULATING SYSTEMS FOR SMALL LABORATORY AQUARIA. Zoologica (N. Y.), Vol. 42, No. 1, pp. 1-10.

Detailed explanations are given for the construction and maintenance of miniature circulating systems. These include open and closed freshwater systems and closed marine systems. These have been designed for laboratory use primarily in connection with ichthyological experimentation. (Auth. abst.)

*1784. Wood, E. J. Ferguson. 1956. CONSIDERATIONS ON PRODUCTIVITY. Jour. Conseil Perm. Internatl. Explor. Mer., Vol. 21, No. 3, pp. 280-283.

Generation times of phytoplankton spp., grazing rates and selectivity of feeding of zooplankton, and influence of heterotrophy are studies which are essential to interpret the dynamic processes involved in the productivity of the seas. Present methods of sampling and techniques used to estimate standing crop have serious errors, and do not help explain the dynamics. Culture experiments correlated with field observations would allow for equations with quantitative meanings for estimating population dynamics. (N. W. R.)

*1785. Kuthalingam, M. D. K. 1956. THE FOOD OF TWO GREY MULLETS OF THE MADRAS COAST. Jour Madras Univ., Vol. 26B, No. 2, pp. 319-326.

Stomach contents of 312 Mugil dussumieri and 408 Mugil caeruleo-maculatus were examined. Adults were found to be bottom feeders having diets of Foraminifera, polychaetes, sand and organic debris. Juveniles feed on algae, copepods and larvae found in surface plankton. (D. E. F.)

*1786. Bogorov, V. G., and M. E. Vinogradov. 1955. OSNOVNYE CHERTY RASPREDELENIYA ZOOPLANKTONA V SEVERO-ZAPADNOI CHASTI TIKHOGO OKEANA. /BASIC CHARACTERISTICS OF THE DISTRIBUTION OF ZOOPLANKTON IN THE NORTHWEST PART OF THE PACIFIC OCEAN./ Trudy Inst. Okeanol. Akad. Nauk SSSR, Vol. 18, pp. 113-123.

The zone of boreal waters (from the Komandorskie and Aleutian Islands to 40°N.) and the zone of the warm waters of the Japan current, both of which are associated with certain plankton complexes, are delimited. For the moderately cold waters of the northern region, Calanus cristatus, C. tonus, Eucalanus bungii, Sagitta elegans, Eukrohnia hamata, etc., are characteristic. At the zone of junction between the cold and warm waters there is an abrupt change in the animal life, accompanied by an increase in the kinds of spp. and a decrease in density of population of 10 to 20 times compared with boreal waters. This zone is the border between the various zoogeographic areas. In the waters of the Japan current with a temperature of 17°-18°C., various warm-water representatives, such as Pteropoda, Heteropoda, Sergestidae, Hyperiidae, salpacea siphonophores, etc., are usual. Certain surface spp. living in the northern areas sink to depths of 200 to 500 to 1000 m. in direct proportion to their southerly excursions (to 30°N.). The distribution of the plankton population in the boreal region makes possible the delineation of three zones within it. In cold waters the greatest population density is near the surface; in the cold intermediate layer (50 to 200 m.) an abrupt decline in population density occurs; in warm waters the population becomes more dense with increase in depth, reaching a maximum at 50 to 100 m and then decreasing abruptly. Quantitative seasonal changes were traced only for boreal waters. The greatest plankton densities were seen from May to July (biological spring) in the surface layers, but from August to October (biological summer) many copepods began to descend into the deeper layers. An attempt is made to relate the plankton distribution with predictions regarding concentrations and migration of whales. (B. A.)

*1787. Kriss, A. E., and E. M. Markianovich, 1954. NABLYUDENIYA ZA SKOROST'YU

RAZMNOZHENIYA MIKROORGANIZMOV V MORSKIKH GLUBINAKH. /OBSERVATIONS ON THE RATE OF MULTIPLICATION OF MICRO-ORGANISMS IN THE DEPTHS OF THE SEA./ Mikrobiologiia, Vol. 23, No. 5, pp. 551-560.

Determination of the intensity of bacterial multiplication was carried out on culture plates. For this purpose, microscrope slides were fastened to rubber stoppers, and lowered into the sea on a rope to varying depths. After 5, 10, 15 and 24 hours of exposure, the slides were brought out of the water, dried, fixed over a flame and stained for 24 hours with a 1% solution of erythrosine in 5% carbolic acid. When the stained slides were examined with the microscope, both single cells and the microcolonies with varying numbers of cells were enumerated. Having used the formula which was derived by N. D. Jerusalimsky (Mikrobiologiia 23(5): 561-570. 1954) for calculating the rate of multiplication on the culture plates, the mean daily relationship between the production of bacteria and the biological mass (p/B) in various seas was calculated according to the following formula:

$$p/B = \frac{4\Sigma \lg m \cdot n}{Nt} \times 24,$$

where m is the average number of cells in each group of microcolonies, n the number of microcolonies in each group, t the time that the slide remained in the sea and N the sum of all the microcolonies and individual cells. According to preliminary data, the ratio between the daily production of bacteria and their biological mass comes out to 13% for the Black Sea, 35% for the Caspian Sea and 80% for the Pacific Ocean. The value for the daily increment in the biological mass of the bacteria is in the range of 7.8 mg/m^3. (B. A.)

*1788. Manuilova, E. F. 1955. O SVYAZI IZMENCHIVOSTI PELAGICHESKIKH CLADOCERA S RAZVITIEM BAKTERII V VODOEME. /THE RELATION OF THE VARIABILITY OF PELAGIC CLADOCERA TO THE DEVELOPMENT OF BACTERIA IN THE WATER./ Doklady Akad. Nauk SSSR, Vol. 103, No. 6, pp. 1111-1114.

Dimensions of the body of Cladocera and the development of protuberances from its carapace depend on the conditions of nourishment of the animal. An increase in the concentration of bacteria in the water produces an increase in the ratio of the height of the carapace of Bosmina coregoni to its length, an increase in the ratio of the length of the body of Daphnia longispina hyalina to the height of its head, and an increase in the dimensions of the body of both kinds of animal. (B. A.)

*1789. Petipa, P. S. 1955 NABLYUDENIE NAD POVEDENIEM ZOOPLANKTONA VO VREMYA SOLNECHNOGO ZATMENIYA. /OBSERVATIONS ON THE BEHAVIOR OF ZOOPLANKTON DURING A SOLAR ECLIPSE./ Doklady Akad. Nauk SSSR, Vol. 104, No. 2, pp. 323=325.

On June 30, 1954, three series of catches of plankton were made at 0 to 5 and 5 to 14 m below the surface: at the beginning of the solar eclipse, at the moment of the greatest obscurement of the solar disk, and the end of the eclipse. It is explained that most (more than 70%) of the zooplankton reacted to the decrease in illumination by rising to the surface, returning to the depths when it was restored. Migration was greatest among the sagittas and the larvae of decapods and molluscs, least among polychaete larvae. The migrations observed took place under the direct action of light and out of all relation to the usual diurnal rhythm which, in the author's opinion, confirms the hypothesis that the vertical migration of zooplankton arose in the evolutionary process under the influence of diurnal changes in illumination. (B. A.)

*1790. Maeda, H. 1956. STATISTICAL ANALYSES OF THE INFLUENCES OF VARIOUS LIGHTS UPON THE DISTRIBUTION OF FISHES IN AQUARIUM. III. EFFECTS OF CONDITIONS OF ADAPTATION AND OF PRESENCE OR ABSENCE OF THE WEAK LIGHT. Bull. Japanese Soc. Sci. Fish, Vol. 22, No. 1, pp. 5-8.

Previously the effect of weak light upon distribution of fish in an aquarium was determined. In a subsequent experiment, light was placed in front of the aquarium and conditions of adaptation and illumination were altered. Different filters made no difference in light colors. 3d experiment was conducted without front light. Differences in any factor or interaction of factors (with or without front light, back light, filters or with darkness) gave no significant difference in distribution of fish. (B. A.)

*1791. Sommani, Ernesto. 1957. LIMNOLOGIA DEI LAGHI ARTIFICIALI. IV. I LAGHI ARTIFICIALI ALPINI--OSSERVAZIONI BIOLOGICHE. /LIMNOLOGY OF ARTIFICIAL LAKES. IV. ARTIFICIAL ALPINE LAKES--BIOLOGICAL OBSERVATIONS./ Boll. Pesca, Piscicolt. e Idrobiol., Vol. 11, No. 1, pp. 5-30.

It is evident that the presence of mud in some basins during long periods inhibits the development of plankton. At the same time, the absence of planktonic organisms does not mean unproductiveness because the muddied waters can give good results in the production of fishes that are not plankton feeders. (B. A.)

*1792. Kinne, O. 1956. UBER TEMPERATUR UND SALZGEHALT UND IHRE PHYSIOLOGISCH-BIOLOGISCHE BEDEUTUNG. /CONCERNING TEMPERATURE AND SALT CONTENT AND THEIR PHYSIO-BIOLOGICAL SIGNIFICANCE./ Biol. Zentralbl, Vol. 75, Nos. 5/6, pp. 314-327.

Salt content is important in influencing the water and mineral economy of cells. Deprivation of "free" inter-micellar water reduces vitality yet increases

resistance against external influence. Reversal to higher metabolism and lowered resistance follows an increase in free water. Temperature and salt content have a mutual interrelation, which often involves viscosity. An oceanographic application is suggested as an explanation of fresh-water invasion of marinotropic organisms. Hindering or even blocking of biochemical reactions may accompany water extraction, causing decrease in or halting of oxygen exchange with the exterior. (B. A.)

*1793. Isii, K., and M. Inoue. 1956. SOME NOTES ON THE OVARY OF ALBACORE, GERMO GERMO, TAKEN FROM THE CORAL SEA. Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 2, pp. 89-93.

Ripe and un-ripe ovaries were found in 1954. Two ovarian samples of nearly the same length, 28 and 29 cm, weighed 289.1 and 101.5 g, respectively. Albacore are presumed to spawn in the Coral Sea. (B. A.)

*1794. Honma, Yoshiharu. 1957. ON THE PITUITARY GLAND OF SOME JAPANESE TELEOSTS. Japanese Jour. Ichthyol., Vol. 5, No. 3/6, pp. 175-181.

Pituitary glands of more than 30 spp. of Japanese teleosts are described. In general, the basic structure is more similar among more closely related spp. (M. G.)

*1795. Kafuku, Takeichiro. 1957. ECOLOGICAL AND PHYLETIC SIGNIFICANCE OF ANAL FIN BETWEEN CYPRINIDS AND CATOSTOMID FISH. Japanese Jour. Ichthyol., Vol. 5, No. 3/6, pp. 163-173.

The relation between morphology and the mode of living is discussed in cyprinid and catostomid fishes. (M. G.)

*1796. Andrew, F. J., P. C. Johnson, and L. R. Kersey. 1956. ELECTRIC SCREENS FOR ADULT SALMON. International Pacific Salmon Fisheries Commission, Progress Report: New Westminster, B. C., Canada, 43 pgs.

Tests were conducted in Sweltzer Creek at Cultus Lake, B. C. in 1953 to investigate effectiveness of various electric screens for deflecting and guiding adult sockeye and pink salmon. The electric screens tests consisted of 2 parallel rows of 1-inch diameter vertical electrodes energized with direct, interrupted direct, 60-cycle alternating, and half- and full-wave rectified alternating current. These electric screens were effective in stopping the fish provided the electrical stimuli caused a sufficient impairment of the fish's swimming ability and the water velocity exceeded 2.0 feet/second. In lower water velocities, some fish were killed even when the galvanotropic stimuli were used. A distinct disadvantage of the electric screens tested was that fish made repeated efforts to penetrate the electrified zone rather than lead along it to a by-pass. The fish also seemed to become fatigued after repeated electrical exposures. (B. A.)

*1797. Suda, Akira. 1956. STUDIES ON THE ALBACORE. III. SIZE COMPOSITION CLASSIFIED BY OCEAN CURRENTS. Bull Japanese Soc. Sci. Fish., Vol. 21, No. 12, pp. 1194-1198.

There is a discrepancy of about 10 cm between the modal length of albacore caught in the North Equatorial Current and the Equatorial Counter-Current in the western North Pacific. This phenomenon may have a close relation with the sex ratio. Variation in size between the North Pacific Current area and the other 2 current areas is greater than regional and seasonal differences within this area. A considerably different environment for tuna is indicated for each current area. (Auth. summ.)

*1798. Helvey, T. C. 1955. RADIOACTIVITY IN OCEAN SCIENCE. Bull Internatl. Oceanogr. Found. Vol. 1, No. 3, pp. 20-24.

Uses and possibilities for radioactive isotopes in marine research. (J. L. McH.)

*1799. Finn, D. B. 1957. RADIOACTIVITY AND WORLD FISHERIES. Bull. Internatl. Oceanogr. Found., Vol. 3, No. 3, pp. 180-186.

Review of the problem of disposal of radioactive wastes and their possible effects upon marine life. (J. L. McH.)

*1800. Ershoff, B. H., and E. Geiger. 1957. DEVELOPMENT OF METHODS FOR BIOASSAY OF GROWTH FACTORS PRESENT IN FISHERY INDUSTRIAL PRODUCTS--PRELIMINARY INVESTIGATION OF PRESENCE OF UNIDENTIFIED NUTRITIONAL FACTORS. Commercial Fish. Rev., Vol. 19, No. 5a, pp. 4-6.

Increment in body weight is a poor index of the role of food in growth, because many factors affect body weight. Preliminary studies of physiological stress-factors in test animals, using alpha estradiol and thyroactive substances in excess, as possible methods of measuring unidentified growth-factors in fish meals, gave promising results, but the method was time-consuming and expensive. (J. L. McH.)

*1801. Genovese, Sebastiano. 1957. ULTERIORI OSSERVAZIONI SUI CARATTERI BIOMETRICI DEL TONNO (THUNNUS THYNNUS L.) TIRRENICO. IL TONNO INTERGENETICO DELLO STRETTO DI MESSINA. /FURTHER OBSERVATIONS ON BIOMETRIC CHARACTERS OF THE TUNNY (THUNNUS THYNNUS L.). THE INTERGENETIC TUNNY OF THE STRAIT OF MESSINA./ Boll. Pesca, Piscicolt. e Idrobiol., Vol. 11, No. 1, pp. 83-120.

The author studied 197 specimens of T. thynnus caught with hook and line from October 1952 to February 1953 in the Strait of Messina. The population was found to have the same morphological characters as those previously studied from the n.-e. coast of Sicily, and these 2 populations can be considered as having characteristics peculiar to the tunnies of the Tyrrhenian Sea. (From auth. summ.)

*1802. Remington, Jack D. 1957. SAGA OF THE SOCKEYE. Bull. Internatl. Oceanogr. Found., Vol. 3, No. 2, pp. 98-108.

Life history of Oncorhynchus nerka, and the work of the International Commission. (J. L. McH.)

*1803. Moulton, James M. 1957. A COLLECTION OF DRAWINGS OF FISHES ASCRIBED TO J. P. KIRTLAND (1793-1877) IN THE LIBRARY OF BOWDOIN COLLEGE. Breviora. Mus. Comp. Zool. (Harvard), Vol. 80, pp. 1-5.

Kirtland's original drawings for 57 of the illustrations accompanying his "Descriptions of the fishes of the Ohio River, Lake Erie and their tributaries", published from 1840 to 1846 in the Boston Journal of Natural History, are located in the library of Bowdoin College. (B. A.)

*1804. Kusa, Mamoru. 1957. OSMOTIC BEHAVIOR OF ISOLATED CORTICAL ALVEOLI OF STICKLEBACK EGGS. Annot. Zool. Japon., Vol. 30, No. 2, pp. 67-70.

The envelopes of the cortical alveoli in the unfertilized eggs of Pungitius pungitius work as osmotic membranes permeable to water, urea, ethylene glycol, glycerin and various basic dyes. Thereby, the membrane appears not to be a simple homogeneous lipoid layer, but to have some specialized area or areas thereon which permit the penetration of either water or certain lipoid-soluble substances. (Y. W.)

*1805. Lemanova, N. A. 1955. ANALIZ YAVLENIYA STERIL'NOSTI U SAMTSOV GIBRIDA LUDOGA (COREGONUS LAVARETUS LUDOGA POL.) X RIPUS (COREGONUS INFR. LODOGESIS. PRAV.). /ANALYSIS OF THE OCCURRENCE OF STERILITY IN MALES OF THE HYBRID LUDOGA (COREGONUS LAVARETUS LUDOGA POL.) X RIPUS (COREGONUS INFR. LODOGESIS. PRAV.)./ Doklady Akad. Nauk SSSR, Vol. 105, No. 1, pp. 160-162

When females of the whitefish ludoga are crossed with males of the whitefish ripus, the resulting males are sterile. Reciprocal crossing gives females and males with normal fertility. Histological examination of the testes of sterile hybrids showed that the primary spermatocytes had degenerated. (B. A.)

*1806. Tinbergen, N. 1956. STEKELS, VEILIG EN VOORDEELIG. /SPINES, SAFE AND ADVANTAGEOUS./ Levende Natuur, Vol. 59, No. 2, pp. 25-33.

A 20-cm pike kept in an aquarium appeared to grab a stickleback (Gasterosteus aculeatus) but could not swallow it because of the erected spines of that prey. It quickly learned to avoid sticklebacks. Quantitative observations with several pikes clearly demonstrated that pikes prefer roaches (Leuciscus sp.) above sticklebacks, and the nine-spined stickleback, with its smaller spines, above the three-spined. A description is given of the anatomical features of the spines, which makes it clear just how the stickleback can keep them erect so well and with so little effort in case of danger. The behavior of both species of stickleback under natural conditions is discussed in terms of adaptive divergence. The considerable protection offered by the spines made it possible for the three-spined stickleback to inhabit the more open waters and to develop brightly colored courting males. (P. K.)

*1807. Loven, Per Magnus. 1956. THE CONGER, ITS OCCURRENCE AND DISTRIBUTION IN NORTHERN WATERS. Vidensk Meddel. Dansk Naturhist. For. Kobenhavn, Vol. 118, pp. 53-69.

Conger conger records from northern waters (35 Swedish, 47 Danish, 4 German, 17 Norwegian) are tabulated. In addition there are 2 doubtful reports from Finland. Swedish and Danish finds have been more numerous in the last 20 years. Information from light-ships as to average salinity at 5 m levels in Kattegat in 1945-53 compared with that in 1923-39 indicates an increase in salinity. Reported times of arrival are discussed, as well as possible reasons for predominance of females in catches, and some general information is given on life history. In Europe there has been a considerable increase in the catch of congers, especially since 1946. (B. A.)

*1808. Yoshida, Hiroshi, and Takeo Ito. 1957. FISH FAUNA OF THE JAPAN SEA. Jour. Shimonoseki Coll. Fish., Vol. 6, No. 2, pp. 261-270.

Japan Sea is divisible into 3 faunal areas of fishes, namely, southern, middle and northern. Senzaki and Yoshimi, both in the Prefecture Yamaguchi belong to the southern area. Shimane district being intermediate in the faunal characters belongs to the middle area. The northern area extends north of Toyama. These faunal areas are in harmony with oceanic currents in the Japan Sea. Tsushima warm current runs northward along the coast of the Japan Sea and a branch enters the strait of Tsugaru, but the main current is far to the west coast of Hokkaido and it holds southern fishes. As cold water remains deep off the coast of the Japan Sea, many districts harbor northern fishes. Southern fishes are in the majority in the warm waters south of the Shimane coast. (Auth. summ.)

*1809. Bogorov, V. G., and K. B. Beklemishev. 1955. O PRODUKTSII FITOPLANKTONA V SEVERO-ZAPADNOI CHASTI TIKHOGO OKEANA. /THE PRODUCTION OF PHYTOPLANKTON IN THE NORTHWEST PORTION OF THE PACIFIC OCEAN./ Doklady Akad. Nauk SSSR, Vol. 104, No. 1, pp. 141-143.

To determine the primary production in the Pacific Ocean at the time of the voyage of the "Vityaz" in Sept. and Oct. 1954, use was made of the "bottle method" (water, taken from various depths, was poured into bottles which were placed in the aquarium on deck). The oxygen content in each of the bottles was determined and served as a measurement of the amount of primary production.

The data obtained, expressed in terms of milligrams of carbon fixed per liter per day, was entered on the map of the area of water being examined. It was established that in the warm waters of the Japanese current the primary production decreases abruptly in comparison with the waters of the boreal region, and the magnitude of production of phytoplankton of the area investigated is close to that observed under similar conditions in other portions of the ocean. (B. A.)

*1810. Corner, E. D. S., and F. H. Rigler. 1957. THE LOSS OF MERCURY FROM STORED SEA-WATER SOLUTIONS OF MERCURIC CHLORIDE. Jour. Marine Biol. Assoc. United Kingdom, Vol. 36, No. 3, pp. 449-458.

The rate of loss of mercury from stored sea-water solutions of mercuric chloride has been measured by means of chloroform-dithizone titrations and by the use of Hg^{203}. It has been found that more than 80% of the mercury added to the sea water (0.1 - 1.0 mg Hg/l) is lost from solution in one week, and this rate of loss is much faster when the sea water contains nutrients favoring the growth of bacteria. Bacteria developing in the sea water also influence the loss of mercury qualitatively. Thus, most of the mercury lost from enriched sea water is attached to the walls of the glass vessel and a small quantity is volatilized from solution. However, sea water to which no nutrients have been added loses mercury mainly to the atmosphere and only a small amount is attached to the walls of the vessel. It is apparent, therefore, that the distribution of mercury between the atmosphere and the walls of the vessel is greatly influenced by the conditions under which bacteria develop in the sea-water medium. The form in which the lost mercury volatilizes from solution is not known at present. It has been found, however, that the volatile compound (s) can be adsorbed on activated animal charcoal. (E. D. S. C.)

*1811. Cushing, D. H., A. J. Lee, and I. D. Richardson. 1956. ECHO TRACES ASSOCIATED WITH THERMOCLINES. Jour. Marine Res., Vol. 15, No. 1, pp. 1-13.

Echoes received from the depth of the thermocline in Windemere, the North Sea, the Barents Sea, and off Spitsbergen, have been associated with aggregations of plankton organisms: zooplankton at a density of 25/l in Windemere and phytoplankton at a density of 100,000 cells/l (Thalassiosira gravida and Chaetoceras sp.) in the Barents Sea. (Auth. abst.)

*1812. Deacon, G. E. R. 1957. DEEP OCEAN CURRENTS. Discovery, Vol. 18, No. 9, pp. 386-387.

A brief description is given of a sonic device which sinks until its density is equal to that of the sea water. It can then be followed by its transmitted impulses as it is carried by deep currents. (R. W. D.)

*1813. Smith, F. G. Walton. 1957. OCEANOGRAPHY AND INDUSTRY. Bull. Internatl. Oceanogr. Found., Vol. 3, No. 1, pp. 2-8.

The value, present and potential, of oceanographic research to the fisheries, chemical and oil industries, shipping and aviation, navigation instrument manufacturer, and others are discussed. (J. L. McH.)

*1814. Sutcliffe, W. H., Jr. 1957. AN IMPROVED METHOD FOR THE DETERMINATION OF PRESERVED PLANKTON VOLUMES. Limnology and Oceanography, Vol. 2, No. 3, pp. 295-296.

The method utilizes colorimetric determination of the solution volume in which plankton is preserved, using a coloring material, e.g., India ink, that is not taken up by plankton. (Auth. abst.)

*1815. Anonymous. 1957. MYSTERY OF THE RED TIDE. Bull. Internatl. Oceanogr. Found., Vol. 3, No. 1, pp. 21-31.

Historical account of the phenomenon, and description of research off the Florida coast that led to understanding the conditions that cause outbreaks, and successful predictions. (J. L. McH.)

*1816. Gorshkova, T. I. 1955. O SKOROSTI RASPADA ORGANICHESKOGO BESHCHESTVA FITOPLANKTONA TAGANROGSKOGO ZALIVA. / THE RATE OF DECOMPOSITION OF ORGANIC MATTER OF PHYTOPLANKTON OF TAGANROG BAY. / Doklady Akad. Nauk SSSR, Vol. 104, No. 1, pp. 112-113.

To establish the causes for the very small content of organic matter in the bottom material of the Sea of Azov, phytoplankton, gathered in August 1951 in Taganrog Bay, with a preponderance of the sp. Anabaena, was investigated for moisture, C, N, and P content and rate of decomposition. Data on the quantity of moisture and quantity of C and N were close to those for Anabaena from Lake Beloe, and of P, for those from Lake Vinogradov. The organic matter of the blue-green organisms appeared to be easily decomposed. Decomposition of organic matter under laboratory conditions and in the sea took place very quickly; the principal decomposition product of the blue-green organisms was methane. (B. A.)

*1817. DiCostanzo, Charles J. 1957. GROWTH OF BLUEGILL, LEPMIS MACROCHIRUS, AND PUMPKINSEED, L. GIBBOSUS, OF CLEAR LAKE, IOWA, Iowa State Coll. Jour. Sci., Vol. 32, No. 1, pp. 19-34.

Age and growth determinations were made from scales of 1215 bluegill and 336 pumpkinseed collected from 1947 to 1954. Both spp. grew more rapidly in Clear Lake than in most midwest waters. Male bluegill of age groups II and III were larger than females of corresponding ages. Exceptionally strong year-classes of bluegill and pumpkinseed originated in 1951, and very weak year-classes in 1949. Strong bluegill year-classes occurred in 1946 and 1952. Fluctuations in abundance of both spp. appear to be closesly associated with changes in density of aquatic vegetation. Bluegill weight

increased as the 3.45 power of the standard length; that of pumpkinseed, as the 3.19 power. (Auth. summ.)

*1818. Fedy S. P., and L. D. Belyaev. 1955. OPYT PRIMENENIYA MELKOYACHEINYKH SETEI DLYA OTLOVA MALOTSENNYKH I SORNYKH RYB V VODOKHRANILISHCHAKH. /AN EXPERIMENT IN THE USE OF FINE-MESH NETS FOR CATCHING LOW-VALUE AND WASTE FISH IN RESERVOIRS./ Voprosy Ikhtiologii, 1955 No. 5 pp. 163-169.

The results of experimental work on catching, with fine-mesh nets, coarse fish in reservoirs for improving their fish fauna are given. Two kinds of nets are compared: single-walled, and triple-walled. Single-walled nets must be used, since an excessively large number of young, commercially valuable fish are taken by triple-walled nets. (B.A.)

*1819. Foskett, D. R. 1954. CONTRIBUTIONS TO THE LIFE HISTORY OF THE SOCKEYE SALMON. Rept. Brit. Columbia Dept. Fish., 1953, pp. 33-51.

Results of sampling the main sockeye salmon (Oncorhynchus nerka) runs along the central and northern coastline of British Columbia. Detailed data are given on the age composition, growth and sex ratio of the 1953 catch in the Nass River, Skeena River, Rivers Inlet and Smith Inlet fisheries, and these are compared with data obtained in previous years. (J.C.S.)

*1820. Foskett, D. R. 1955. CONTRIBUTIONS TO THE LIFE HISTORY OF THE SOCKEYE SALMON. Rept. Brit. Columbia Dept. Fish., 1954, pp. 32-50.

Sampling in 1954 of the main sockeye salmon (Oncorhynchus nerka) catches along the central and northern coastline of British Columbia are compared with past results. Data are given on the age composition, growth, and sex ratio of the catch in the Nass River, Skeena River, Rivers Inlet, and Smith Inlet areas. (J.C.S.)

*1821. Foskett, D. R. 1956. CONTRIBUTIONS TO THE LIFE HISTORY OF THE SOCKEYE SALMON. Rept. Brit. Columbia Dept. Fish., 1955, pp. 28-50.

Sampling in 1955 of the main sockeye salmon (Oncorhynchus nerka) catches along the central and northern coastline of British Columbia are compared with past results. Data are given on the age composition, growth, and sex ratios of the catch in the Nass River, Skeena River, Rivers Inlet, and Smith Inlet areas. (J.C.S.)

*1822. Inaba, Densaburo. 1953. ON THE BREEDING AND HYBRIDIZATION AMONG THE SALMONOID FISHES I. Jour. Tokyo Univ. Fish., Vol. 39, No. 2, pp. 215-222.

Hybridization between Salmo fontinalis and Oncorhynchus masou, and between the former and O. rhodurus was carried out and the hybrids obtained have been reared since 1944 at Oizumi Trout Hatchery of Tokyo University. The results are summarized as follows: The two hybrids grow about 40 cm in length and are larger than the river form of O. masou and O. rhodurus which are about 20 cm. They live 8 years or more in a rearing pond. The wavy black streaks in S. fontinalis are inherited dominantly and spread downward to the ventral portion of the body. Nuptial color in the breeding season appears the same as in S. fontinalis. Other characters resemble the male O. masou or O. rhodurus. Red spots on the sides and the white margin on the front edges of the fins disappear in the two hybrids. The wavy black streaks in the rhodurus hybrid are broader than those of the O. masou hybrid. Scales of the 2 hybrids are round in contrast to the ellipsoid form in S. fontinalis, but with few (10 to 12) continuous circuli on the exposed area. The male in the two hybrids has little milt. The female of the O. masou hybrid is sterile, but that of rhodurus had a few eggs. Releasing these hybrid fry may be a procedure for the maintenance of river trout fishing, because of their closer adaptability to the native environment and easiness of obtaining fry or fingerling in hatcheries. (Auth. summ.)

*1823. Karamchandani, S. J. 1957. ON THE OCCURRENCE OF ASSOCIATES OF CARP FRY IN THE FRY-COLLECTION NETS AND THE DESTRUCTIVE ROLE PLAYED BY PREDATORY FISH. Indian Jour. Fish., Vol. 4, No. 1, pp. 47-61.

The extent of association of the undesirable sp. of fish with carp fry in fry-collection nets at Dighwara has been shown, thereby evaluating Dighwara fry collection center as a source of major carp fry. The percentage composition of undesirable sp. of fish, along with other details with regard to their size, frequency of occurrence with carp fry, etc., have been studied. A list of larvae and fry of predatory and nuisance fish which were concurrently found with carp fry in fry-collection nets in 2d, 3d and 4th quarters, has been given. Aquatic organisms (other than fishes) which associate constantly with carp fry in fry-collection nets, have been recorded along with their frequency of occurrence, and their role in fish culture has been elucidated. The dietary habits of 12 spp. of predatory fishes have been studied. (Auth. summ.)

*1824. Kataoka, Akiyoshi. 1957. RESULTS OF TUNA LONG LINE FISHING IN THE MIDDLE INDIAN OCEAN. Jour. Shimonoseki Coll. Fish., Vol. 6, No. 2, pp. 241-248.

From December 15, 1954 to January 14, 1955 experimental longlining in the central part of the Indian Ocean showed that schools of tuna were widely distributed. Yellowfin were 79% of the total catch, mostly 130-140 cm in body length. 20.2% of the catch fell victims to shark attacks. Albacore increased gradually southwestward from 68°E, 3°S. (Auth. summ.)

*1825. Long, E. John. 1957. ANGLERS VERSUS SPEARMEN. Bull. Internatl. Oceanogr. Found.,

Vol. 3, No. 3, pp. 130-141.

Development of skin diving since World War II has raised serious controversy between anglers and spear fishermen. Various steps in the controversy are reviewed, and the basic issues outlined. (J. L. McH.)

*1826. McFadden, James T. 1957. CHARACTERISTICS OF TROUT ANGLING AT LAWRENCE CREEK, WISCONSIN. Trans. Wisconsin Acad. Sci., Arts and Lett., Vol. 45, pp. 21-29.

Complete creek census records were kept by a compulsory angling permit system. During the 19-week season, 4653 hours of angling yielded 3040 brook trout and 177 rainbow trout, or 0.67 fish per hour. Angling intensity amounted to 495 hours per acre. 27% of the year's catch was taken in the first week and 48% in the first 5 weeks. 62% of fishing pressure occurred on weekends. 11% of the anglers caught 51% of the season's catch; 53% caught no fish. 60% of the anglers lived more than 50 miles from the stream. Recruitment to the legal-sized group during the season was slightly less than the catch. (W. C.)

1827. Jackson, Samuel W., Jr. 1958. COMPARISON OF THE AGE AND GROWTH OF FOUR FISHES FROM LOWER AND UPPER SPAVINAW LAKES, OKLAHOMA. Proceedings of the Eleventh Annual Conference, Southeastern Association of Game and Fish Commissioners, October 20-23, 1957, pp. 232-247.

A study was made of the growth rates of fishes from two reservoirs located on the same mainstream in northeastern Oklahoma; one a 31-year old reservoir, and the other a two-year old reservoir. Four species of fishes from each lake were selected for study; the largemouth bass as a representative predator or game species, the white crappie as a representative pan fish, the gizzard shad as a forage species, and the spotted sucker as a rough or coarse fish.

Sixty-seven species of fish have been recorded from that part of Spavinaw Creek upstream from the dam of the Lower Lake. Gill-nets, rotenone, seines, and wire traps were used for collecting. The growth rates of four species studied in the Upper Lake were faster than those of the same species from the older Lower Lake. Rapid growth of the fishes occurred in the new impoundment in the first two years of impoundment, but appeared to decline as the reservoir became older. Prolonged draw-down of the Lower Lake during 1951-1953 apparently retarded growth during the 1953 growing season. Substantial increases in growth were noted in most species following a return to normal water level in 1954. (Auth. summ.)

*1828. Moorman, Robert B. 1957. REPRODUCTION AND GROWTH OF FISHES IN MARION COUNTY, IOWA, FARM PONDS. Iowa State Coll. Jour. Sci., Vol. 32, No. 1, pp. 71-88.

During an investigation of the condition of fish populations in Marion County farm ponds, data on age, growth, reproduction and scales were collected from many of the fish to give a picture of the growth rate of pond fish (largemouth black bass, bluegill, white crappie, black bullhead) in this region. (Auth. summ.)

*1829. Prabhu, M. S. 1956. MATURATION OF INTRA-OVARIAN EGGS, THE SPAWNING PERIODICITIES IN SOME FISHES. Indian Jour. Fish., Vol. 3, No. 1, pp. 59-90.

From a study of the intra-ovarian eggs, the spawning periods, their duration and seasons have been indicated in the case of 9 species of edible teleostean fishes. Intra-ovarian eggs in mature ovaries of different species of fishes have been classified into 4 stages of maturity and the range in size and structure of ova in different stages of development have been studied. The 9 species of fishes selected for the present study have been observed to exhibit 4 different types of spawning. Therapon jarbua, Macrones vittatus and Chirocentrus dorab were found to spawn only once a year, the spawning period in each species being restricted to a definite and short period. Though Pelates quadrilineatus and Cypsilurus oligolepis spawn only once a year, the duration of spawning was observed to extend over a long period. The spawning in Psammoperca waigiensis, Therapon puta and Caranx (Selaroides) leptolepis was found to be restricted to a definite and short period but these species seem to spawn more than once a year. In Stolephorus indicus though there is a definite periodicity in spawning, this species apparently spawns throughout the year intermittently. No correlation could be established between the sizes of individuals and mature eggs with the types of spawning exhibited by the different species. The curves showing the frequencies of intra-ovarian eggs in various stages of maturity and the spawning periods and habits of the 9 species have been compared with studies of other species. (Auth. summ.)

*1830. Reid, George K., Anthony Inglis, and Hinton D. Hoese. 1956. SUMMER FOODS OF SOME FISH SPECIES IN EAST BAY, TEXAS. Southwestern Nat., Vol. 1, No. 3, pp. 100-104.

Stomach contents are reported for 83 croaker (Micropogon undulatus) and 280 sand trout (Cynoscion arenarius); also for a few individuals each of sheepshead (Archosargus oviceps), sand perch (Bairdiella chrysura), gafftopsail catfish (Bagre marinus), spadefish (Chaetodipterus faber) flounder (Paralichthys lethostigma), and redfish (Sciaenops ocellata). Variety is characteristic in the diets of all spp. Populations of these fishes depend upon an adequate supply of small fishes, shrimps, and mollusks. (Auth. abst.)

*1831. Saha, K. C., and N. K. Chowdhury. 1956. STUDIES ON THE MORTALITY IN SPAWN AND FRY OF INDIAN MAJOR CARPS DURING TRANSPORT. I. INVESTIGATIONS RELATING TO THE USE OF SPECIFIC SOIL (RED SOIL) WATER MEDIUM IN TRANSPORTING CARP SPAWN ("DIMPONA") IN THE EXISTING TRADE TO CHECK MORTALITY DURING TRANSMIT. Indian Jour. Fish., Vol. 3, No. 1, pp. 119-126.

The specificity of water, collected from the spawn catching center and used as the medium for transport of spawn by the existing traders could not be established. Tank water, having pH of 7.8 - 8.5 and minimum dissolved O_2 of 4 ppm, was found to be as satisfactory as the water of the spawning ground. Mortality occurred almost instantaneously in distilled water, possibly due to the absence of mineral ingredients. Red soil used by the traders in the water medium during transport was found to have very little special effect on spawn life. Ordinary soil, in finely pulverized condition, was found to be as effective. Addition of pulverized soil, however, generally increased the survival period to a great extent. In acid pH, mortality was almost instantaneous. Survival period was maximum at pH 8.5 and decreased with increased alkalinity. The lesser the concentration of spawn, the greater was the survival period. For economical transport in trade practice, a concentration of about 1500 spawn/1000 cc water was found to be advantageous. Long route transport tolerance test carried out using tank water and ordinary soil and adjusting to pH 8.5. For a journey of about 56 hours by rail, mortality was only to the extent of 3-4% excepting in 1 case. (Auth. summ.)

*1832. Saha, K. C., D. P. Sen, and P. Mazumdar. 1956. STUDIES ON THE MORTALITY IN SPAWN AND FRY OF INDIAN MAJOR CARPS DURING TRANSPORT. II. EFFECT OF OXYGEN PRESSURE, FREE SURFACE AREA, WATER VOLUME AND NUMBER OF FRY IN THE MEDIUM OF TRANSPORT. Indian Jour. Fish. Vol. 3, No. 1, pp. 127-134.

The number of fry that could be packed in a sealed system under O_2 appeared to be proportional to the pressure under which O_2 was initially applied. Any concentration of dissolved O_2 above 0.5 ppm seemed to be sufficient for maintaining life of fry of length up to 5.08 cm. The rate of O_2 consumption by a fry appeared to be proportional to its size or body weight. The maximum number of fry, of different size-groups or weight, that could be kept in a closed system with 1 square cm. of free surface area at 1280 mm O_2 pressure and a temperature of 31°C without disturbing O_2 balance, was worked out. The minimum volume of water that should be supplied for fry of different size-groups or weight was determined. The number of fry that could be packed in a medium appeared to vary directly with its free exposed surface area, provided there was minimum water volume required by each fry of a particular size-group. (Auth. summ.)

*1833. Saha, K. C., D. P. Sen, and P. Mazumdar. 1956. STUDIES ON THE MORTALITY OF SPAWN AND FRY OF INDIAN MAJOR CARPS DURING TRANSPORT. III. EFFECT OF INIMICAL SUBSTANCES FROM DECOMPOSITION OF METABOLIC PRODUCTS IN THE MEDIUM ON SPAWN LIFE AND THEIR CONTROL. Indian Jour. Fish., Vol. 3, No. 1, pp. 135-140.

The inimical effect of NH_4 and CO_2, (formed in transport from the decomposition of metabolic products) on spawn life has been described. Different absorbents like permutit, activated charcoal, "Amberlit" (I.R. 100) and pulverized earth were tried for rapid removal of CO_2 and NH_4 to see if the survival period could be increased. Pulverized earth activated charcoal and "Amberlit" were found to absorb the gases from the medium, with consequent increase in the survival period. Spawn was found to stand a concentration of 20 ppm of dissolved CO_2, 2.5 ppm of dissolved free NH_4 and 15 ppm of dissolved NH_4 in the form of inorganic salts. Addition of secondary sodium phosphate (Na_2HPO_4) to the water-spawn medium was found to reduce the period of transport from 64 to 40 hours. (Auth. summ.)

*1834. Syazuki, Keiichiro, and Kazuhiko Hayama. 1957. STUDIES ON NUTRITION OF CARP-FRY. Jour. Shimonoseki Coll. Fish., Vol. 6, No. 2, pp. 255-260.

To measure O_2 consumption of carp-fry (below 1 gram in body weight), either starved or fed, apparatus of running water type was used. O_2 consumption in mg/kg/24 hour, of carp fry starved for 2-10 days and for 2 months respectively, were 10320 and 4560 at 23$\pm$ 1°C. water temperature. The Q_{10} value of carp-fry starved for 2 months was 2.1-3.5. It was found that O_2 consumption attained a maximum value within 1-2 hours after feeding, but decreased later, and became nearly constant after 12 hours and equal to that of fry starved for less than 10 days. O_2 consumption of carp fry at 21°$\pm$ 2°C increased about 17% with feeding. Carp fry fed on raw beef liver for 4 months had an O_2 consumption of 30-50 Cal/kg/day in terms of metabolic energy; the higher the temperature and the lighter the body weight, the greater the relative O_2 consumption. The less the protein content of the food, the less the O_2 consumption. O_2 consumption of fry fed on food of 60% protein content was abnormally large. (From auth. summ.)

*1835. Thomson, James M. 1956. THE PENETRATION OF ESTUARINE FISH INTO FRESHWATER IN THE ALBERT RIVER. Proc. Roy. Soc. Queensland, Vol. 68, pp. 17-20.

Twenty spp. of fish, 4 of them freshwater, the remainder estuarine, are recorded from the lower freshwater zone of the Albert River. Mugil cephalus and Craterocephalus stercus-muscarum are the only permanent members of the community; the other spp. occur seasonally or transiently. (Auth. synopsis)

*1836. Woynärovich, E. 1955. BIOLOGISCHE BEOBACHTUNG IM ZUSAMMENHANGE MIT DER KUNSTLICHEN ZUCHTUNG VON FISCHEN. /BIOLOGICAL OBSERVATIONS IN RELATION TO THE ARTIFICIAL PROPAGATION OF FISH./ Acta Biol. Acad. Sci. Hungaricae, Vol. 6, No. 1/2, pp. 149-169.

Environmental conditions need to be controlled

to yield the greatest number of food fish, pike (Esox lucius), pike perch (Lucioperca lupioperca), carp (Cyprinus carpio), bream (Abramis), catfish (Silurus glanis), grown artificially in Hungary. Temperature and hormonal influences are important for spawning in fish. Newly-laid eggs show no structure under the microscope. They later assume their spherical shape, rotate until the micropyle is up, are fertilized and show their polarity. The eggs swell and the membranes are surrounded by a sticky substance which seems to be albuminous and colloidal in nature. Embryological stages are described briefly. Anomalies were frequently seen. With the rise in temperature, the oxygen need increases and must be supplied to the developing fish. The greatest sensitivity to jarring occurs just prior to the closing of the blastopore. Large numbers of bream die during spawning. (M. G.)

*1837. Schmidt, W. J. 1955. UBER DENTIKEL BIE EINEM FISCH (SARGODON). /ON THE DENTICLES OF FISH./ Publ. Staz. Zool. Napoli, Vol. 27, pp. 331. 334.

The pulp cavity of the teeth of vertebrates often contains spherical formations due to a concentric deposition of dentine. These denticles are formed by odontoblast cells that have penetrated into the pulp cavity. Denticles found in the teeth of teleosts (Sargodon) are here described for the first time. (Auth. summ.)

*1838. Shamardina, I. P. 1954. IZMENENIE INTENSIVNOSTI DYKHANIYA RYB V TECHENIE IKH RAZVITIYA. /CHANGES IN THE INTENSITY OF RESPIRATION OF FISH IN THE COURSE OF THEIR DEVELOPMENT./ Doklady Akad. Nauk SSSR, Vol. 98, No. 4, pp. 689-692.

A systematic study was made of the intensity of respiration in pike during the first year of life after hatching from spawn. Experiments lasted from 2-18 hours. After the experiment the length and weight of the fish were measured (dry after fixation in 10% formalin solution). The respiratory intensity increased rapidly at the start of growth and then decreased. In young pike with a length of 7-8 mm the respiratory intensity equalled 0. 8 mg O_2/g of dry weight per hour; it reached 1. 9 mg O_2 in the young during increased activity. The greatest respiratory intensity was observed in 17-18 mm long pike (10 mg O_2/g dry weight per hour). Later, a decrease in the respiratory intensity occurred, which decreased to 2 mg O_2/g of dry weight on reaching the length of 60-70 mm, and 0. 4-0. 8 mg/g of dry weight of a length of 300-600 mm. The author believes that the increase in respiratory intensity is connected with gradual consumption of the yolk and the formation of actively respiring tissues. The fall in respiratory intensity is connected with the increased size of the body, but not with the decrease of the important surface-vascular type of respiration. (B. A.)

*1839. Smirnov, A. I. 1955. VLIYANIE MEKHANICHESKIKH VOZDEISTVY NA RAZVIVAYU-SHCHUYUSYA IKRU OSENNEI KETY (ONCORHYNCHUS KETA INFRASP. AUTUMNALIS BERG, SALMONIDAE). /THE INFLUENCE OF MECHANICAL ACTIONS ON DEVELOPING ROE OF THE AUTUMN SIBERIAN SALMON (ONCORHYNCHUS KETA INFRASP. AUTUMNALIS BERG, SALMONIDAE). Doklady Akad. Nauk SSSR, Vol. 105, No. 4, pp. 873-876.

Experiments carried out in piscicultural establishments in the Sakhalin district indicated the great resistance of Siberian salmon roe, at the beginning of its swelling, to mechanical procedures. After a blow in water the sensitivity of roe in 10 minutes is temporarily markedly increased, but afterwards diminishes, falling to a low around the beginning of crushing. In the stage of the clearly visible embryonic band, a diminution of roe sensitivity to mechanical actions was noted; in the stage of closing of the blastopore it increased again. At termination of the overflowing of the yolk sac of the blastoderm and closing of the blastopore, well before the beginning of eye pigmentation, the sensitivity of the roe diminished. A comparison of the findings on the Siberian salmon and on the sickle fish indicated that in the 2nd species the roe are more sensitive to mechanical actions. (B. A.)

*1840. Manter, Harold W. 1957. HOST SPECIFICITY AND OTHER HOST RELATIONSHIPS AMONG THE DIGENETIC TREMATODES OF MARINE FISHES. Union Internatl. Sci. Biol. Ser. B. 32, pp. 185-198.

The location of Digenea within their hosts, convergent evolution among the Digenea, host specificity among Digenea of fishes, and speciation and evolution among Digenea of fishes are discussed, with various tables showing the families of Digenea known as parasites of certain types of fishes, and the host distribution for certain groups of Digenea. (B. A.)

*1841. Vrabec, F. 1955. SURLES CONES TRIPLES DE LA RETINE DES TÉLÉOSTÉENS. /THE TRIPLE CONES IN THE RETINA OF TELEOSTS./ Věstnilc, Československ. Zool. Spolecnosti, Vol. 19, No. 2, pp. 183-186.

The study of the tengential sections of Squalius cephalus, Tinca vulgaris and Cyprinus carpio revealed exteriorly to membrana limitans externa the presence of triple cones, known only as developmental anomaly in the amphibian tadpoles (Saxén, 1953) so far. In Teleostei they are evidently of normal occurrence. (V. J. A. N.)

*1842. Albuquerque, Rolanda Maria. 1954-1956. PEIXES DE PORTUGAL E ILHAS ADJACENTES. CHAVES PARA A SUA DETERMINAÇÃO. /FISHES FROM PORTUGAL AND THE ADJACENT ISLANDS: IDENTIFICATION KEYS./ Portugaliae Acta Biol. Sér. B., Vol. 5, pp. 1-1164.

This treatise includes the following parts: I- Introduction, II-Classification, III-External morphology, IV-Keys for the determination of the Classes, V-Cyclostomata, VI-Elasmobranchii, VII-Holocephali, VIII-Actinopterygii, IX-Bibliography, X-Vernacular names index, XI-Systematic

index, XII-Analytical index. In the introduction the aims of this work, the first of its kind in Portugal, are explained. It follows the classification of the fishes after Berg (1940) and Goodrich (1930). In the chapter devoted to the external morphology the main features of body shape and regions, integument, skull, fins, respiratory organs and swim bladder, reproduction, migrations and habitat are dealt with. Keys for the identification of the classes, orders, fam., gen., spp., and sspp. are provided. The main part of this treatise deals with the description of 681 spp. and sspp. Each description is followed by data on: body length and width, vernacular names, commoner synonyms, bibliographic references (for descriptions), and citations (for the Portuguese records). Biological annotations are given for several spp. A prefacial note by Prof. J. A. Serra precedes the author's introduction. (C. N. T.)

*1843. Thines, G. 1956. LES POISSONS AVEUGLES (1) ORIGINE--TAXONOMIE--REPARTITION GEOGRAPHIQUE--COMPORTEMENT. /THE BLIND FISHES. 1. ORIGIN, TAXONOMY, GEOGRAPHICAL DISTRIBUTION, BEHAVIOR./ Ann. Soc. Roy. Zool. Belgique, Vol. 86, No. 1, pp. 5-128.

Since blind fishes occur in many different taxonomic groups, data on them was rather scattered. This monograph gathers them together. A list of the known blind spp. is considered to be more useful at present than an attempt at a general interpretation. The introduction discusses the complexity of the problem, and the need for defining more precisely the different factors of the "environmental conditions." Then there is a discussion of 7 theories as to the cause of this blindness. A systematically arranged list is given totalling 86 spp., of which 41 are freshwater, 29 marine, and 16 of brackish water, distributed in 19 fam. A detailed treatment follows, giving for each sp. synonymy, length, coloration, data on habitat, and details as to the condition of the eyes. Distribution maps are given; 1 for freshwater spp. and 1 for the marine and brackish water spp. Representation by families and by continents is tabulated, with discussion. Behavior of some specimens of Caecobarbus, Anoptichthys, and Barbus conchonius (these last blind due to mutation), living in an aquarium, are described. The bibliography lists 56 references. (B. A.)

*1844. Bush, Robert R., and Thurlow R. Wilson. 1957. TWO-CHOICE BEHAVIOR OF PARADISE FISH. Jour. Exptl. Psychol., Vol. 51, pp. 315-322.

Samples were run in a T-maze: one side was correct 75% of the time, the other side the remaining 25% of the time. Control samples were run in the conventional manner while experimental samples were allowed to observe the presence or absence of food on both sides of the maze. Two stochastic models are discussed: one model predicts an increment of probability of a particular choice as a function of food placement on the preceding trial and thus a distribution of approaches about .75. A "secondary reinforcement model" predicts that the sight of food in the opposite box reinforces the response just made and thus 100% approach to one side or the other. The data support this latter model. (J. A.)

*1845. Kozlovsky, D. A. 1956. O MIGRATSIONNOM INSTINKTE Y RYB. /ON THE MIGRATORY INSTINCT IN FISH. Zool. Zhur., Vol. 35, No. 2, pp. 266-274.

Starting from Pavlov on conditioned reflexes, the spawning migration of fish is interpreted as a return to the places where the fish were born and where they developed a complex of conditioned connections with the environment, with a large role played by chemical and certain other stimuli (e.g., organic and mineral suspended matter, in some cases oil contaminating the stream, or phytocides entering the water, and so on). During spawning migration, fish guided by specific stimuli are impelled in a direction where all the properties of the water recall those existing in their birthplace. The migrations of some fish in the basin of the Kuban and Don Rivers, and also of eels from the Sargasso Sea to Europe, are explained similarly. (B. A.)

*1846. Spiecker, D. 1957. DIE GALVANOTAXIS DER FISCHE UND IHRE AUSLÖSUNG AUF GRUND UNMITTELBARGER IRRITABILITÄT DER RUMPFMUSKULATUR. Zool Jahrb. Abt. allg. Zool. u. Physiol. Tiere, Vol. 67, No. 2, pp. 229-260.

Investigation of the electrical field showed that the body of the fish is a good conductor with a less good conducting membrane in a badly conducting medium. By use of curare it was shown that galvanotaxis in fish rests on the stimulation of the trunk musculature by the electrical current. To obtain a galvanotactic response it is necessary to evoke by muscle contractions a locomotion similar to normal locomotion. This could be substantiated by study of fish with special types of locomotion. Thus flatfishes show a galvanotactic reaction only when the electrodes are arranged vertically to the flat body thus evoking movements normal to this type of fish. Fish that swim by fins only, without trunk undulations, do not exhibit galvanotaxis although they give signs of perceiving the current. (L. H. H.)

*1847. Barlow, John P. 1956. EFFECT OF WIND ON SALINITY DISTRIBUTION IN AN ESTUARY. Jour. Marine Res., Vol. 15, No. 3, pp. 193-203.

The distribution of salinity in a small tidal estuary, Great Pond, over a period of a year is described. The numerous important variations in salinity, both seasonal and short-term, cannot be attributed to tides or to day-to-day changes in the supply of fresh water, but to day-to-day changes in wind force and direction. The general seasonal change in average salinity is related to a general

seasonal change in prevailing winds. (Auth. abst.)

*1848. le Roux, P. J. 1956. FEEDING HABITS OF THE YOUNG OF FOUR SPECIES OF TILAPIA. S. African Jour. Sci., Vol. 53, No. 2, pp. 33-37.

The stomach contents of the young stages of four species of Tilapia, T. mossambica, T. melanopleura, T. sparrmani and T. andersoni, were examined to determine whether any changes in diet occur as the fish grow older. The results are expressed graphically and show that all the species prefer zooplankton at lengths under two inches. From two to three inches they eat almost all available food. From three inches upwards, the preference is for the food of the adult stages. T. mossambica and T. andersoni take mainly phytoplankton. T. melanopleura feeds mainly on plant material. T. sparrmani is omnivorous with particular preference for bottom food. (From auth. abst.)

*1849. Shekhanova, I. A. 1956. O VOZMOZHNOSTI USVOENIYA RYBAMI NEORGANICHESKOGO FOSFORA IZ VODY. (THE POSSIBILITY OF ASSIMILATION OF INORGANIC PHOSPHORUS FROM THE WATER BY FISH) Doklady Akad. Nauk SSSR, Vol. 106, No. 1, pp. 161-164.

Experiments were conducted on year-old scaly and smooth carp. $Na_2PH^{32}O_4$ was added to the water in which the fish were in the amount of 0.1-0.005 mg/l and 20-200 μc/l. After a time the fish were killed and the P^{32} concentration was determined in the blood, scales, bones, muscles, gills, oral mucosa, various portions of the intestines, liver, spleen, kidneys and the brain. The highest P^{32} concentration was found in the scales, the lowest in the bones and kidneys. The largest amount of P^{32} enters the body of the fish through the scales and oral cavity, the least through the entire body surface. Absorption of inorganic P^{32} occurs in all parts of the intestines, but most intensively in the anterior portions. The amount of P^{32} which enters the organism of the fish in certain stages depends on its concentration in the water. Temperature conditions evidently do not exert any significant effect on the process of the absorption of P^{32} into the body of a fish. (B. A.)

*1850. Burke, Jack D., and William S. Woolcott. 1957. A COMPARISON OF THE BLOOD OXYGEN CAPACITY IN THE BLACK CRAPPIE (POMOXIS NIGROMACULATUS) AND THE BLUEGILL (LEPOMIS MACROCHIRUS). Virginia Jour. Sci., Vol. 8, No. 2, pp. 113-120.

Blood O_2 capacity in 20 specimens of black crappie (Pomoxis nigromaculatus) and 20 specimens of bluegill (Lepomis macrochirus) was determined by the Roughton-Scholander microgasometric syringe method. The black crappie and the bluegill had a mean body weight of 71 and 86 g, a mean standard length of 132 and 133 mm, and a mean blood O_2 capacity of 8.5 and 7.4 vols. %, respectively. Statistically, a significant difference existed between the blood O_2 capacities of the spp. Total blood O_2 capacity increased with an increase in body weight. However, as the body weight increased, the O_2 capacity of the blood per gram of body weight decreased. There was no indication of sexual dimorphism for this character. It was also found that the blood coagulated in 30 seconds or less in each sp. (Auth. abst.)

*1851. Butskaya, N. A. 1955. OB OSOBENNOSTYAKH SEMENNIKA U RYB S RAZLICHNYMI TIPAMI NERESTA. (ON THE CHARACTERISTICS OF THE SEMINIFEROUS TUBULE IN FISH WITH DIFFERENT TYPES OF SPAWNING.) Doklady Akad. Nauk SSSR, Vol. 100, No. 4, pp. 809-812.

Material was collected in different seasons of the year in the deltas of the Volga and Ural Rivers. In fish spawning only once (pike, perch, sturgeon, Caspian roach), complete maturation is characteristic for the pre-spawning condition of the seminiferous tubules (in the spermatic ductules there are only ripe spermatozoa). After the fluid stage (onset connected with the temperature), within a few days the rutting stage sets in; the spermatozoa vanish from the spermatic ductules. In fish whicn spawn off and on, spermatogenesis occurs differently. In certain fish (carp) lengthy spawning in males is explained by the slow extraction of the sperm and its gradual replenishment by the continuation of spermatogenesis all year through; in the Volga herring Caspialosa volgensis, different zones of the seminiferous tubule mature at different times. In the Volga and Ural bream, the prolongation of spawning is connected with the ripening at different times of the cysts along the whole length of the seminiferous tubule. Differences in the functioning of the gonads in fish with different types of spawning cannot be explained by a distinction in the course of the initial stage of spermatogenesis alone study of the mechanism of all phases of gametogenesis is necessary, as well as of the process of sperm extraction in the spawning period. (B. A.)

*1852. Yanagimachi, Ryozo. 1957. STUDIES OF FERTILIZATION IN CLUPEA PALLASII. I. EXTENSION OF FERTILIZABLE LIFE OF THE UNFERTILIZED EGGS BY MEANS OF ISOTONIC RINGER'S SOLUTION. Zool. Mag. (Dobutsugaku Zasshi), Vol. 66, No. 5, pp. 218-221.

The unfertilized eggs of the herring (Clupea pallasii), when exposed to sea water, lose their fertilizable capacity in 5 hours. In isotonic Ringer's solution (M/4.5 NaCl 100 cc; M/4.5 KCl 3.5 cc; M/6.7 $CaCl_2$ 1.5 cc; M/6.7 $MgCl_2$ 2.4 cc; pH 7.6) these eggs remain fertilizable for 24 hours or more and fertilization and development proceed quite normally. Fifty percent sea water, nearly isotonic to the Ringer's solution, can also be used. (K. A.)

*1853. Yanagimachi, Ryozo. 1957. STUDIES OF FERTILIZATION IN CLUPEA PALLASII. II. STRUCTURE AND ACTIVITY OF SPERMATOZOA. Zool. Mag. (Dobutsugaku Zasshi), Vol. 66, No. 5, pp. 222-225.

The spermatozoon of the herring (Clupea pallasii) consists of a rounded head (1.5μ x 2.0μ) and a middle piece (1μ in diameter) provided with a long slender tail (40μ in length). Hemocytometric count indicates that the number of sperm in one mm^3 of dry sperm is $0.8\text{-}1.0 \times 10^8$. They are almost motionless even after they are mixed in sea water or in isotonic Ringer's solution and gradually form a number of small clusters sticking together their heads 15 to 30 minutes later. Such a tendency cannot be altered by temperature, osmotic pressure, ionic composition and pH. (K. A.)

*1854. Yanagimachi, Ryozo. 1957. STUDIES OF FERTILIZATION IN CLUPEA PALLASII. III. MANNER OF SPERM ENTRANCE INTO THE EGG. Zool. Mag. (Dobutsugaku Zasshi), Vol. 66, No. 5, pp. 226-233.

Although the spermatozoa of the herring (Clupea pallasii) are almost motionless even when they are set free in sea water or in Ringer's solution, they become active when brought around the micropyle of a mature egg. A spermatozoon enters the micropyle 5 or 10 seconds after insemination, and many sperm follow it, but they cannot penetrate into the egg proper and are expelled at last in 30 to 40 minutes after insemination, thus resulting in monospermic fertilization. Masses of aggultinated sperm are often seen around the micropyle of the developing embryo. It is assumed that gynogamon 1-like substance is present in mature egg and plays a role in activation of sperm. (K. A.)

*1855. John, Kenneth R. 1957. COMPARATIVE RATES OF SURVIVAL OF NORMAL AND DEFORMED CHUB, GILA ATRARIA, GIRARD, IN TWO OCEAN LAKE, TETON COUNTY, WYOMING. Proc. Pennsylvania Acad. Sci., Vol. 31, pp. 77-82.

A collection of 20,000 chub contained 0.91% individuals with various degrees of curvature of the vertebral column. The majority of deformed fish represented age groups 0 to IV. A sharp and progressive decrease in numbers of deformed fish characterized age groups V and up. (Auth. abst.)

*1856. Onkst, H., J. Jacoby, and D. G. Scarpelli. 1957. EFFECT OF CALCIUM BINDING SUBSTANCES ON RATE AND DURATION OF NARCOSIS. Proc. Soc. Exptl. Biol. and Med., Vol. 96, No. 2, pp. 397-399.

During narcosis there is a loss of cellular Ca and liquefaction of the cortical gel. Alterations of Ca balance were produced in male guppies (Lebistes reticulatus) by placing them in Ca-free solutions, or by the addition of sodium citrate or ethylenediamine tetra-acetate (EDTA). Pentobarbital was used to induce narcosis. Induction time was shortened when chelating agents were given simultaneously with pentobarbital. EDTA had the greatest effect in shortening induction time and prolonging recovery time, even when balanced with Ca. When fish were pre-treated to remove Ca the induction time was prolonged. Additional observations are made regarding the role of Ca in narcosis. (Auth. abst.)

*1857. Yamamoto, Kiichiro. 1956. STUDIES ON THE FORMATION OF FISH EGGS. I. ANNUAL CYCLE IN THE DEVELOPMENT OF OVARIAN EGGS IN THE FLOUNDER, LIOPSETTA OBSCURA. Jour. Fac. Sci. Hokkaido U. VI. Zool., Vol. 12, No. 3, pp. 362-373.

In the mature fish, the young oocytes, both at the chromatin nucleolus and at the early perinucleolar stages, are present the year round, and further developmental stages appear in succession from the end of May to the following March, after which the eggs rapidly ripen into maturity. In the immature fish however, the oocytes do not further develop beyond the 5th, or primary yolk stage, which endures from late September to early April. In the adolescent fish, though without egg spawning, a tentative maturation of the oocytes occurs rhythmically, as in mature specimens. The zoning of the cytoplasm observed in abortive oocytes during the off season seems to be in active process preparatory for their reorganization, rather than a mere symptom of degeneration. After the spawning of the ripe eggs, the reserve fund oocytes begin to grow into the active eggs of the current season's crop, and the young oocytes into the reserve fund eggs for the following season. (Y. W.)

*1858. Yamamoto, Kiichiro. 1956. STUDIES ON THE FORMATION OF FISH EGGS. II. CHANGES IN THE NUCLEUS OF THE OOCYTES OF LIOPSETTA OBSCURA, WITH SPECIAL REFERENCE TO THE ACTIVITY OF THE NUCLEOLUS. Jour. Fac. Sci. Hokkaido U. VI. Zool., Vol. 12, No. 3, pp. 375-390.

Karyologically the oogenesis of this flounder is found to be nearly the same as those of other teleosteans. Chromatin nuceoli are present in the youngest oocytes, but not for the true nucleoli; one or two strongly basophilic nuceoli which appear in the next, peri-nucleolus stage are regarded to be true nucleoli, because of lack of direct continuity to the spireme. In subsequent oogenetic stages certain nucleoli, probably those originating from chromatin nucleoli, gradually arrange themselves close to the nuclear membrane. After the breakdown of the germinal vesicle they change into convoluted threadlike bodies, soon to lose their stainability and eventually to disappear. Nucleolar extrusion occurs within the period ranging from the early peri-nucleolus to the secondary yolk stages, the nucleoli assuming throughout these stages a vesicular structure. The substance extruded from the nucleolar fragments into cytoplasm is studied with methyl green pyronin staining, and interpreted in the light of Caspersson's views on cellular nucleic acid. (Y. W.)

*1859. Yamamoto, Kiichiro. 1956. STUDIES ON THE FORMATION OF FISH EGGS. III. LOCALIZATION OF POLYSACCHARIDES IN THE OOCYTES OF LIOPSETTA OBSCURA. Jour. Fac. Sci. Hokkaido U. VI. Zool., Vol. 12, No. 3, pp. 391-399.

Non-sulfated mucopolysaccharide is shown to be contained in both yolk granules and yolk vesicles, and in the cortical alveoli of the mature eggs as well, for these structures show a Hotchkiss positive reaction, but no metachromasia with toluidine blue. In the nucleoplasm however, this substance occurs only after the migratory stage of the germinal vesicle. According to Hotchkiss test and treatment with saliva, the mucopolysaccharide in the hyaloplasm seems to change into glycogen during the transition from the primary to tertiary yolk stage, but at the maturation stage this glycogen thus produced is again transformed into mucopolysaccharide. The polysaccharide reaction in the zona radiata is very strong in the earlier stages of oogenesis, but gradually weakens as the membrane thickens. In the ripe eggs it becomes almost negative, the polysaccharide therein probably being replaced by the protein formed. The chemical reactions in the formation of the egg membrane are discussed. (Y. W.)

*1860. Wolf, Ken, and C. E. Dunbar. 1957. CULTIVATION OF ADULT TELEOST TISSUES IN VITRO. Proc. Soc. Exptl. Biol. and Med., Vol. 95, No. 3, pp. 455-458.

An investigation was initiated to determine methods whereby tissues from salmonid fishes could be cultivated in commercial media. Tissues from several species of trout were grown for over two months in media composed of 5% embryo extract, 20% serum, 30% synthetic medium 199, and 45% Earle's solution. Results of comparisons of various components of the media are given. (Auth. abst.)

*1861. Sandels, E. G. 1956. AN INSTRUMENT FOR THE MEASUREMENT OF SALINITY IN ESTUARIES. Jour. Sci. Instruments, Vol. 33, No. 11, pp. 424-428.

The instrument is carried in a boat, water being pumped through it from an intake which is lowered into the estuary. Electrical conductivity and temperature are measured and the salinity is computed readily from a nomogram. Radio-frequency circuits are employed for the measurements, the indicator being a milliammeter operated from a d. c. amplifier. The accuracy is better than $\pm$ 1/3 parts per thousand over a salinity range of from 0.2-50 ppt. (Auth. summ.)

*1862. Fields, Paul E., and A. Keith Murray. 1956. THE RESPONSE OF YOUNG SILVER SALMON TO A LIGHT BARRIER AFTER THREE LEVELS OF LIGHT ADAPTATION. University of Washington School of Fisheries, Tech. Rept. 27, pp. 1-9.

Sixteen groups of 25 yearling Oncorhynchus kisutch were tested for guidance in an experimental flume with 2 f. p. s. velocity under 4 combinations of light adaptation and barrier illumination. Five minutes of adaptation to an 8-ft. -c. level outside the flume significantly increased the guiding effectiveness of the 8 ft. -c. light barrier in the otherwise darkened flume 5 seconds later and was accompanied by the longest swimming times. Adaptation to 100 ft. -c. destroyed the guiding effectiveness of the 8 ft. -c. light barrier and greatly reduced the swimming time. Any light in the flume significantly increased the swimming time over that obtained in the dark. (P. E. F.)

*1863. Adkins, Ronald J., and Paul E. Fields. 1957. CONDITIONING YOUNG STEELHEAD TROUT TO COLORED LIGHTS. University of Washington School of Fisheries, Tech. Rept. 33, pp. 1-20.

Twenty hatchery-reared Salmo gairdnerii, approximately 2 years old, were conditioned to approach either of 2 filtered equal energy light areas (a red or a green) simultaneously presented at opposite ends of a shuttle box discrimination apparatus. Ten fish were shocked in the red and 10 in green. The criterion for success was errorless performance on 10 consecutive trials. Sixteen fish met the criterion on the 1st day after an average of 9.3 pre-criterion trials when equated energies were used. On the 2nd day a significant reduction to an average of 4 pre-criterion trials for 17 was observed. Of the 3 which had not yet met the criterion (all red-positive fish), 1 met it in 3 trials when the energy of the red was reduced, and all 3 met it with an average of 17 trials when the relative energy of the red was increased. Eight of these fish were next trained to an equated energy color reversal problem. All met the criterion on 2 reversals, but only 3 were successful on the 3d reversal. The fish made more errors on each succeeding reversal. (P. E. F.)

*1864. Finger, Gary L., and Paul E. Fields. 1957. THE ROLE OF LIGHT ADAPTATION ON NEGATIVE PHOTOTAXIS IN SILVER SALMON (ONCORHYNCHUS KISUTCH). University of Washington School of Fisheries, Tech. Rept. 34, pp. 1-25.

Eighty-four groups of 25 yearling salmon were each given 3 successive trials to a light guiding situation in water flowing at 2 f. p. s. to determine the extent of light avoidance when each of 3 light barrier illuminations were paired, in 7 combinations, with different environmental brightnesses. Dark-adapted fish displayed a significant avoidance of the 10, 20 and 40 ft. -c. light barrier. Light adaptation at various environmental intensities in the flume invariably reduced the consistency of the negative phototaxis to the barrier. The best guidance was obtained under conditions of maximum contrast. When the environmental area was brighter than or equal to the barrier, the consistency of guidance disappeared. Although all subjects had been drawn from the same brood stock, groups subjected to different rearing and treatment procedures varied in the degree of light avoidance. Under light conditions of maximum contrast, the 2d trial results showed a highly significant improvement, but the 3d trial showed no further progress in light avoidance. (P. E. F.)

*1865. Johnson, Donald E., and Paul E. Fields. 1957. THE APPLICATION OF CERTAIN CON-

DITIONING AND HANDLING TECHNIQUES TO THE GUIDANCE OF DOWNSTREAM MIGRANT SALMON. University of Washington School of Fisheries Tech. Rept. 35, pp. 1-56.

The effects on the light avoidance behavior of yearling Oncorhynchus kisutch of anesthetization, tattooing and exposure to dim light and to pulsed A. C. electroshock singly and paired in conditioning situations were studied in a circular tank and a shuttlebox apparatus. In the tank, electroshock decreased the light avoidance, while dim light alone had no significant effect. Twenty-five millisecond A. C. pulses of 1.5 volts per inch superimposed on 35 millisecond pulses of light significantly reduced the time spent in the light. Fish shocked in the dark eventually learned to enter the light. In the shuttlebox every group given shock showed an impaired physical condition for at least 192 hours. Both anesthetization (with urethane or TCM) and tattooing resulted in an increase in light avoidance beyond the increment produced by paired light and electroshock and persisted for about 96 hours. It is concluded that electroshock is not a suitable agent to condition young downstream migrant salmon to a guiding light stimulus. (P. E. F.)

*1866. Murray, A. Keith, and Paul E. Fields. 1957. RESPONSE OF STEELHEAD TROUT (SALMO GAIRDNERII) TO CONTINUOUS, FIXED INTERVAL AND FIXED RATIO REINFORCEMENT SCHEDULES. University of Washington School of Fisheries, Tech. Rept. 45, pp. 1-10.

Four trout were trained to press against a target for food reinforcement. Rates of response under continuous reinforcement were compared to the rates obtained under intermittent reinforcement, and remained uniform. Under interval reinforcement, the best fish maintained his response rate with a period of 3 minutes between reinforcements. With ratio reinforcement, response rate was maintained by the best fish at 15:1. The results indicate (1) that a distinctive operant response can be established in the steelhead trout, and, by inference, in other salmonoids without the use of electric shock. (2) That Skinnerian techniques applied to an organism where gross locomotor responses must be substituted for manipulatory responses produce comparable results. (3) That the rate of response is high enough and stable enough under intermittent reinforcement to justify application of the method of sensory threshold discrimination studies. (P. E. F.)

*1867. Bowen, Vaughan T., and T. T. Sugihara. 1957. STRONTIUM 90 IN NORTH ATLANTIC SURFACE WATER. Proc. Natl. Acad. Sci., Vol. 43, No. 7, pp. 576-580.

The various test nuclear fission explosions carried out since 1945 have resulted in the worldwide dissemination of detectable amounts of long-lived radioactive strontium 90. This isotope must have been delivered to the Atlantic Ocean essentially completely as fallout, and consequently to the surface layers only. Since the half-life of the radioactivity is long (28 years) compared with the time span over which it has been delivered, measurements of the concentration of radioactivity in seawater strontium may be used to test various hypotheses both of the marine geochemistry of strontium and of the circulatory mechanism of the upper layers of the oceans. The relatively high Sr^{90} concentration of Woods Hole Harbor water, which represents large areas of shallow basins where interaction between water and bottom ought to be maximal, may be taken as indicating that transfer of the radioisotope to sediments must be very slow. It has been estimated from other considerations by Odum that the half-time of strontium in the oceans is about a million years, and, because of the high strontium concentration of sea water, isotope exchange is not expected to favor Sr^{90} transfer to the sediments. (B. A.)

*1868. Jentoft, Ralph E., and Rex J. Robinson. 1956. THE POTASSIUM-CHLORINITY RATIO OF OCEAN WATER. Jour. Marine Res., Vol. 15, No. 2, pp. 170-180.

A method for determining the amount of potassium in ocean water has been described. With this procedure, a number of ocean water samples have been analyzed for potassium, and the potassium-chlorinity ratios have been calculated. The ratio has been found to have a constant value of 0.02023 with a standard deviation of 0.000,032 or 1.6 parts per 1000. (Auth. abst.)

*1869. Churchill, M. A., and R. A. Buckingham. 1956. STATISTICAL METHOD FOR ANALYSIS OF STREAM PURIFICATION CAPACITY. Sewage and Industrial Wastes, Vol. 28, No. 4, pp. 517-537.

A method has been developed by the authors for predicting the maximum reduction in oxygen concentration in a polluted stream under various conditions of pollution load, stream flow and water temperature. Application of the method requires brief, periodic observations of stream conditions over a period of several months. During this period a range of conditions will be observed, and the prediction equations resulting are claimed to be more reliable for critical conditions. Time of passage data are not required and long-term incubation of DOD samples is not necessary. The cost of collecting the necessary data is reasonable. (H. R. A.)

*1870. Baggerman, B. 1957. AN EXPERIMENTAL STUDY ON THE TIMING OF BREEDING AND MIGRATION IN THE THREE-SPINED STICKLEBACK, GASTEROSTEUS ACULEATUS L. Arch. Neerland. Zool, Vol. 12, No. 2, pp. 105-318.

The sticklebacks winter in the sea; migrate to fresh water during the breeding season (April to July), and return to the sea. In part I, experiments were undertaken to determine the factors causing the onset and the end of the breeding season. Successive phases of gonadal development are designated as 0 (under-yearling fish), 1-a, 1-b, 2. Sexual maturity is reached at the end of phase 2. Either of 2 sets of external conditions will reobtain sexual

maturity: short day length (8 hours) and low temperatures (4°-6°C) when the gonads are in phase 1-a, or long day lengths (16 hours) and high temperatures (20°C) when the gonads are in phase 1-b. Since the 1st set of conditions normally prevail in the winter and the 2d in the spring, the timing of breeding is doubly secured, and breeding will take place in spite of variations in climatological conditions. Certain intrinsic factors modify maturation. Fish in phase 0 do not respond to a long day length combined with high temperature, probably because of insufficient production of gonadotrophins. This prevents precocious maturation in autumn of fish hatched in spring and summer. Autumn maturation of fish that have spawned is prevented by the fact that if the gonads reach phase 1-b at this time they will be inhibited by the low temperatures and short days of winter. Fish kept constantly under long day lengths and high temperatures showed an alternation of reproductive and non-reproductive periods. The length of the breeding season is longer with a long day length and high temperature than with a short day and low temperature. In part II, effects of environmental and intrinsic factors on migration are described. Spring migration was connected with a fresh-water preference, whereas the autumn migration is associated with a salt-water preference. Also, the attainment of gonadal maturity was accompanied by preference for fresh water, and gonadal regression with a preference for salt water; however, gonadectomized animals responded in a similar way to unoperated controls, the only difference being that normal fish prefer fresh (or salt) water earlier than gonadectomized fish. Injections of mammalian gonadotrophins indicated that these hormones do not play a primary role in the causation of migration, for 3-4 weeks elapsed between the 1st administrations and the 1st sign of a change in salinity preference. But these hormones may stimulate the secretion of gonadal hormones which in turn stimulate the output of the hormones controlling salinity preference. Increase in the level of thyroxine induces a fresh-water preference within 3-5 days. A theoretical framework is described into which these observations can be fitted. (W. F. W.)

*1871. Jenkins, Robert M. 1956. GROWTH OF BLUE CATFISH (ICTALURUS FURCATUS) IN LAKE TEXOMA. Southwestern Nat., Vol. 1, No. 4, pp. 166-173.

The average rate of growth of blue catfish (Ictalurus furcatus) in Lake Texoma as calculated from examination of spines of 192 individuals, 5 to 44 inches in total length, indicated that a length of 5.7 inches was reached at the end of the 1st year of life, and and in successive years, average total lengths of 10.0, 13.8, 17.4, 21.0, 25.8, 30.3, 34.3, 40.4, 42.1, and 44.0 inches were attained. The length-weight relationship of individuals in the length-range 9.27 inches is described by the equation logW = -2.9988+3.3993 log L, and from 27.45 inches by the equation logW = 3.4110 + 3.7055 log L. The rate of growth was much faster than that exhibited by channel catfish, and nearly equal to flathead catfish growth. Attention should be given to the feasibility of introducing blue catfish into small lakes as a potential sport and food fish. (Auth. abst.)

*1872. Eisler, Ronald. 1957. THE INFLUENCE OF LIGHT ON THE EARLY GROWTH OF CHINOOK SALMON. Growth, Vol. 21, No. 3, pp. 197-302.

Four groups of chinook salmon fingerlings were fed a uniform diet while continuously subjected to a light intensity of 0.02, 88, 116, and 157 foot-candles, respectively, of fluorescent light characterized by a wave-length range of 3350-6000 Å with a mean at approximately 5800 Å Length-weight measurements were recorded periodically during a twelve-week period. The light-reared fingerlings gained an average of 57% more in weight, and 41% more in length, than the dark-reared group. No difference was found between light-reared groups. (Auth. abst.)

1873. Brynildson, Oscar Marius. 1958. LIME-TREATMENT OF BROWN-STAINED LAKES AND THEIR ADAPTABILITY FOR TROUT AND LARGE-MOUTH BASS. Dissertation Abstracts, Vol. XIX, No. 2, p. 389.

Small brown-stained lakes in northwest Wisconsin were studied limnologically before and after treatment with hydrated lime alone and in combination with phosphorus. The adaptability of these treated and untreated lakes to trout and large-mouth bass was studied.

Fish populations in two of the lakes were removed and one lake was re-stocked with trout alone and the other with trout and bass in combination.

As a result of the lime-treatments, the pH rose above neutrality and the alkalinity increased.

Transparency of the water increased in one lake after heavy lime-treatment, but did not increase measurably in the lake which received lesser but frequent lime-treatments.

There was a measurable increase in the filamentous green algae following the lime-treatments. Following the application of phosphorus, was a conspicuous crop of the blue-green algal species, Anabaena planktonica, Microcystis aeruginosa and Aphanizomenon flos-aquae. There were increases and decreases in the abundance of various species of rooted aquatic plants following the lime-treatments.

The planktonic crustacean Holopedium gibberum nearly disappeared from the plankton soon after lime-treatments began and there was a shift in dominance from Daphnia pulex to D. longispina as treatments continued. Holopedium gibberum reappeared in the summer plankton in the fourth year after treatment began. During that year the pH was at or below neutrality because the frequency and intensity of lime application diminished.

A snail, Helisoma sp., increased markedly by the third summer in the lake treated with lime only.

The largest yield of trout to the angler in any

summer was 16.1 pounds per acre. As much as 70 percent of the trout stocked were caught by anglers.

The dominant fish-food organism in the trout stomachs at various seasons of the year were Daphnia pulex and D. longispina. Whenever these large forms were sparse, instantaneous growth rate was low. Moreover, stomachs from rainbow trout which were over 7 inches (178 mm.) in total length rarely contained planktonic Crustacea of any species that was smaller than 1 mm. in length.

The growth rate of trout was best during late spring and early autumn when water temperatures were optimum and fish-food abundant. Coefficient of condition (R) and instantaneous growth rate (k) (based on the difference in natural logarithms of mean weights) of trout had parallel curves but these did not always parallel the curves of growth rate in length.

Marked largemouth bass of age group II moved at random during the summer months in a 16.6 acre lake, but older largemouth bass did not migrate significantly from the original point of capture.

A small number (82) of adult largemouth bass, introduced into a 10.5 acre, fish-free lake, produced a large crop of young bass. One year later there were 1,789 age group I bass as estimated by the Schnabel method.

Young largemouth bass, less than 70 mm. in total length, and rainbow trout stomachs contained similar food, but a detrimental effect due to this competition could not be demonstrated on the basis of the growth rate of the trout.

Lime-treated, brown-stained lakes were adaptable for both rainbow trout and largemouth bass. These lakes prior to treatment were not consistently suitable for trout. (Auth. abst.)

1874. Farris, David Allen. 1958. ABUNDANCE, DISTRIBUTION AND MORTALITY OF JACK MACKEREL, TRACHURUS SYMMETRICUS, EGGS AND LARVAE. Dissertation Abstracts, Vol. XIX, No. 2, p. 391.

The purpose of this study is to describe the distribution, abundance, and mortality of jack mackerel, Trachurus symmetricus (Ayres) 1855, eggs and larvae. These population characteristics are compared with those of the sardine and have relevance to the "critical period" concept suggested by Hjort as a cause of fluctuations in the size of adult populations.

The basic biological and oceanographic data used were collected on cruises of the California Cooperative Oceanic Fisheries Investigations (CCOFI) during 1951, 1952, 1953, and 1954. These cruises were usually made at monthly intervals, over a regular grid of stations. Jack mackerel eggs and larvae were obtained in quantitative plankton hauls from which they were removed, staged, and counted. Counts were adjusted so that all hauls would be comparable to the number found under a standard area, ten square meters of sea surface. The standardized counts were integrated over time and space and adjusted for growth to obtain estimates of abundance.

The jack mackerel is found along the Pacific coast of North America from the Gulf of Alaska to the Revillagigedo Islands, and is taken at least a thousand miles offshore in some parts of its range.

Spawning in the period 1951 to 1954 occurred from Washington to Magdalena Bay, Baja California. Within these boundaries, however, there were seasonal shifts which did not correlate well with the temperature of the upper-mixed layer. The effect of temperature on the rate of development of eggs was also investigated. Regression parameters are given for the developmental rate. The reliability of the regression was checked by direct observation of developing eggs at controlled temperatures.

Spawning in all four years begin in February off southern California and adjacent northern Baja California, and extended southward to central Baja California by April or May. The southern boundary of spawning then moved northward to the Channel Island area. Spawning ceased by October. The peak month of spawning was March in 1951 and May in 1952, 1953, and 1954. About 30 percent of the spawning occurred during the peak month.

A population estimate was made for each stage (size) of larvae at each station. These were summed for the year. An estimate of survival was made by comparing the population estimates of each succeeding stage of larvae.

The annual estimates of survival for 1952, 1953, and 1954 indicate a reasonably constant survival of month-old jack mackerel larvae during these years.

The growth rate of jack mackerel larvae was approximated from data derived by direct observation of developing jack mackerel larvae under laboratory conditions. Early growth cannot be described by a single logarithmic expression, since there is a marked deceleration in the rate of growth about the third day past hatching. However, the growth rate of older fish is logarithmic. Therefore, the growth rate of the larvae was approximated by two successive logarithmic growth curves. A period of poor survival followed by one of better survival was noted. The change occurred during the second week of larval life and may indicate a critical period. (Auth. abst.)

1875. Helm, William Thomas. 1958. SOME NOTES ON THE ECOLOGY OF PANFISH IN LAKE WINGRA WITH SPECIAL REFERENCE TO THE YELLOW BASS. Dissertation Abstracts, Vol. XIX, No. 2, p. 392.

Lake Wingra, on which the following study was conducted, is small (328 acres), shallow (average depth 6.8 feet), alkaline, quite turbid (Secci disk 2-3 feet) and located within the city limits of Madison, Wisconsin. Carp have been abundant, and a problem, for more than 20 years. A carp removal program in 1953, 1954 and 1955 (Neess, Helm and Threinen, 1957) and this study were integrated. An increase in the number of species and total mass of aquatic plants followed a significant reduction in the number

of carp in the lake (415 pounds per acre in Nov. 1953 to 49 pounds per acre in March, 1955).

The most abundant panfish in the lake, in order of decreasing abundance, were white crappies, bluegills, black crappies, yellow bass and perch. Foods of major importance for all these panfish were plankton crustaceans and larvae and pupae of various insects. Time-food studies, in which yellow bass were collected at hourly intervals with a bottom trawl and/or small seine, were conducted in 1955 and 1956. Yellow bass captured in shallow water (less than 4 feet deep) followed a diurnal feeding pattern, consuming more food shortly after sundown and sunrise than during the night. More extensive collections from the deep-water areas revealed two distinct feeding patterns: yellow bass fed continuously throughout day and night; plankton crustacea were the dominant food items during daylight but decreased in importance at night when primarily chironomid larvae and pupae were eaten.

Bathymetric distribution of fish was studied by collecting with surface, midwater and bottom trawls (these, as well as an electrified bottom trawl, are described in the appendix) in the open water areas of the lake and with seines, gill nets and fyke nets along the shoreline. Yellow bass were abundant in the deepest layer of the lake at all times, although part of the population moved into shallow water at night. Bluegills, which were the most abundant fish in the deepest layer during daylight, were nearly absent at night. White crappies were the most abundant fish in surface and midwater levels during both daylight and darkness.

Potential space and food competition varied between daylight and darkness, primarily as a result of movements of fish from one zone or layer of the lake to another rather than because of any changes in food habits.

Growth of Lake Wingra fish, with the exception of largemouth bass, was slower than the southern Wisconsin average. Yellow bass grew very slowly, white crappies, black crappies and bluegills only slightly slower than the same average.

Yellow bass followed a diurnal pattern of movement (moving into shallow water at night), and were seldom collected in areas with even moderately dense vegetation. Aquatic vegetation, which had been scarce, became abundant along the shoreline following intensive carp removal. Rate of growth of yellow bass declined. It seems probable that their diurnal movements are an inherent behavior characteristic and that they are unable to adapt to this particular change, ie., being barred from a universally preferred feeding area in shallow water because of the presence of aquatic vegetation.

Numbers of panfish, which appeared to be quite high, varied during the period of study. There was a general increase following a die-off of older fish in July 1954, followed by a sharp drop in numbers in 1957. Some 4,500 northern pike, from the 1956 hatch and averaging 13.5 inches, were stocked in January 1957. Assuming 75% mortality per year, computation of the amount of food required for these fish to maintain average growth indicated that more than 1/4 million panfish would be consumed in 1957. Although the hatch of some species of panfish was small in 1956 there is reason to believe that increased predation by the northern pike was important in the decrease in number of panfish. (Auth. abst.)

1876. Beeton, Alfred Merle. 1958. THE VERTICAL MIGRATION OF MYSIS RELICTA IN LAKES HURON AND MICHIGAN. Dissertation Abstracts, Vol. XIX, No. 3, p. 601.

This study had three objectives: (1) to establish the vertical migration pattern of a single zooplankton species, Mysis relicta Loven; (2) to determine, from field data, which environmental factors control this behavior; (3) to determine, through laboratory studies, the way in which these factors exert their influence.

Field work was conducted aboard the U. S. Fish and Wildlife Service research vessel Cisco in 1954 and 1955 in Lake Michigan and in 1956 in Lake Huron. Clarke-Bumpus samplers, half-meter nets, and one-quarter-meter nets, were towed horizontally, to collect plankton. Data were secured on light penetration, temperature, pH, dissolved oxygen, and specific conductance.

During the day mysids could be found only in the two meters above the bottom. In the evening they migrated into the overlying strata as the light intensity decreased from fifteen to one foot-candles. Frequently the mysids migrated through the discontinuity layer, when first ascending, but later in the night the majority occurred immediately below this layer. As the length of day decreased following the summer solstice, the mysids ascended progressively earlier and descended later each night (they descended when the light intensity was increasing from 10^{-3} to 10^{-2} foot-candles). Moonlight and fog influenced the extent and time of vertical migration. Small sexually undifferentiated mysids migrated upward farther than the larger sexually differentiated mysids. Males and females exhibited similar migrations.

Experiments were conducted to determine the response of M. relicta to various intensities and wave-lengths of light. The mysid's ability to "dark-adapt" was studied by first subjecting them to an intense light and subsequently observing their response to flashes of light after they had been in total darkness for varying periods of time. They were able to respond to a light intensity of 9.0×10^{-6} foot candles after nine minutes and forty-five seconds in the dark. The action spectrum for the mysid eye was studied by observing the time required for the mysids to respond to light passing through monochromatic filter combinations. The mysid eye has a maximum sensitivity to light with a wave-length of approximately 515 mu; another peak of sensitivity occurs at or below 405 mu. The phototactic response of M. relicta was studied by placing mysids in a glass tube and recording the number of mysids in the unshaded half of the tube after they had been subjected to total darkness or light for several hours. The mysids responded

photopositively unless they had been in total darkness for at least ten hours; then they responded photonegatively.

The following conclusions can be made from the study. The vertical distribution of M. relicta is governed by light and the existing thermal conditions; pH may exert some influence. Dissolved oxygen and specific conductance definitely did not influence the vertical distribution. Sufficient light at the proper wave-lengths to influence mysid behavior (490 mu to 540 mu) penetrates to depths of at least 100 meters. During the day the mysids are photopositive; however, they are restricted to the stratum immediately above the bottom, since they are forced to retreat to this region by a change in light intensity experienced by swimming upward. As the light intensity decreases at sunset, the mysids migrate into the upper strata due to the positive phototaxis and their subsequent stratification is determined by thermal conditions and occasionally by moonlight. The amount of temperature change was the major factor limiting the vertical movement. During the night the phototactic sign changes from positive to negative. This change is accentuated by an increase in sensitivity to light resulting from dark-adaptation. The dawn descent is due to this photonegative condition. (Auth. abst.)

1877. Chavin, Walter. 1958. THE ROLE OF THE PITUITARY-ADRENAL MECHANISM IN THE REAPPEARANCE OF MELANIN AND MELANOPHORES IN THE GOLDFISH, CARASSIUS AURATUS L. Dissertation Abstracts, Vol. XIX, No. 3, p. 602.

A variety of physical and chemical stimuli has been reported to elicit melanogenesis in the goldfish, but the morphological and physiological alterations resulting in such pigmentation remain undescribed. This study was undertaken to determine these changes and the mechanism eliciting them.

Xanthic goldfish exposed to 0.7% increase in salinity became blackened in 2-10 days. Histological examination of series of fish sacrificed at intervals from one hour to nineteen days after such saline increase, revealed altered pituitary cytology, adrenal cortical hypertrophy, and depression of the thyroid epithelial height. After hypophysectomy, however, a similar increase in salinity elicited neither melanogenesis nor histologic change. Evidently, the pituitary or the hormones of the glands under pituitary control, directly or indirectly stimulated the observed formation of melanin.

To determine the hormones responsible for pigmentation, normal and hyposectomized xanthic goldfish received implants of teleostean pituitary, and fragments of optic lobe, head kidney and opisthonephros; injections of 0.7% saline alone or containing ACTH, ACTH - TSH, intermedin, ACTH - intermedin, adrenal cortical extract, or ACTH - adrenal cortical extract; injections of ACTH or intermedin in gelatin, or gelatin vehicle alone.

In hypophysectomized goldfish, the results indicated a direct correlation between melanization and experimental treatment with teleostean pituitary or mammalian ACTH. Normal fish were blackened only with pituitary implants or ACTH in gelatin. As both the level of gonadal development and the thyroid epithelial height were variable in the melanized goldfish, the pituitary hormones stimulating these glands and the secretions of these glands appeared unlikely as factors in the observed melanogenesis. Neither implantation of head kidney containing adrenal tissue, nor injection of adrenal cortical extract blackened the experimental animals, thus indicating that the secretion of the adrenal cortical tissue was not responsible for the appearance of melanophores. The extra-adrenal action of the pituitary factor, ACTH, is evidently responsible for the observed melanogenesis in the goldfish.

The interrenal cells of the goldfish anterior interrenal tissue were atrophied after hypophysectomy and reacted in a manner comparable with the mammalian adrenal cortical cells to ACTH and the various other stimuli described above, thus confirming the previous suggestions concerning their homology. The interrenal cell hypertrophy and the induction of melanophores in the yellow goldfish occurred after ACTH administration but not after intermedin at any dosage level used. These two pituitary factors are not the same hormone as has been postulated.

Degeneration of the lipophores of the xanthic goldfish after hypophysectomy indicated that the pituitary was necessary for lipophore maintenance. Hypophysectomy was reduced to a 4 to 5 minute operation, with a mortality of less than 10%, by development of a simple technique described herein. (Auth. abst.)

1878. Kruse, Thomas Eugene. 1958. THE GRAYLING OF GREBE LAKE, YELLOWSTONE NATIONAL PARK, WYOMING. Dissertation Abstracts, Vol. XIX, No. 3, p. 605.

This is a study of certain features of the grayling population in Grebe Lake fundamental to its management as a recreational resource. Field work was done in the summers of 1952, 1953, and 1954.

Grebe Lake is a eutrophic body of water described as follows: elevation, 8,000 feet; area, 145 acres; maximum depth, 32 feet; ice covered, about 6 1/2 months annually; highest surface temperature recorded, 67°F.; predominant insects by volume and number, Tendipedidae (=Chironomidae) larvae and pupae. By July 14, 1953, an oxygen deficiency in the waters below 20 feet made them unsuitable for fish life. The grayling was introduced in 1921. Rainbow trout were planted in 1907; Cutthroat trout in 1912 (only hybrid trout are present now).

Population estimates in 1953 and 1954 utilized trap nets and a mark-and-recapture method. There were approximately 28,000 grayling in the lake in 1953 and 27,000 in 1954. A population of hybrid

trout was estimated at 2,000 in 1953 and 2,500 in 1954. The standing crop of fish in Grebe Lake each year approximated 81 pounds per acre of which 73 pounds per acre were grayling and 8 pounds per acre were trout.

Both the grayling and the hybrid trout spawned in all four tributaries and the Outlet of Grebe Lake between mid-May and late June. The number of grayling spawning in 1953 was 7,081 and in 1954, 7,878. Enumeration of the trout at the same times showed 674 and 405, respectively.

During 1954 the natural fry production of grayling in the tributaries of the lake was estimated as 236,500 or 2.5 percent of the estimated number of eggs produced by the spawning adults. The greatest cause of mortality during the early developmental period was attributed to dislodgment of the eggs either by subsequent spawners or by changes in water level.

The time of annulus formation for grayling younger than 3 years was prior to June 25. Accurate interpretations of age from scales of grayling after their third year was impossible because of the small annual growth both in body and scale lengths. An additional complication often resulted from an absence of a scale annulus to designate the first year of life. This occurred on fish that were too small to have had scales at the start of their second growing season. The grayling reached the legal size of 6 inches during its second summer of life and matured during its third year of life.

The hybrid trout grew more slowly than the grayling during its first three years of life but more rapidly after age 3. The legal size (6 inches) was attained either in the second or third year of life. Some males of age-group II had matured, but no females matured until they were 3-year-olds.

Neither the grayling nor the trout was predatory. The food of the grayling during its first year of life consisted of small nymphs of aquatic insects, amphipods, and Daphnia. The major item in the diets of adults of both kinds of fishes was found to be dipterous larvae and pupae.

Fishing pressure on Grebe Lake was light with a harvest of only 7.1 percent of the estimated population or 6 pounds per acre in 1953, and 9.9 percent or 8 pounds per acre in 1954.

The combined mortality from anglers and predators in 1954 approximated 4,200 fish or 14.2 percent of the estimated adult population of 29,500 fish. (Auth. abst)

1879. Kuehne, Robert Andrew. 1958. STUDIES ON THE SCHOOLING BEHAVIOR OF THE MINNOWS, SEMOTILUS AND RHINICHTHYS. Dissertations Abstracts, Vol. XIX, No. 3, p. 606.

As an interesting type of vertebrate society, the fish school has received considerable attention from students of behavior during the past thirty years.

My primary goal in this thesis is to gain an understanding of the schooling habits of the stream minnows, Semotilus atromaculatus (Mitchill), and Rhinichthys atratulus (Hermann). The information so gained is related to other studies of schooling. Finally, an explanation of the origin and utility of school behavior is proposed.

Semotilus and Rhinichthys form loosely-knit schools, often composed of these and other minnow species. Groups of small fish (less than 50 mm) remain apart from schools of larger, older specimens. Aggregations are active during summer and fall but not in winter. Spring spawning tends to disrupt schooling.

Single fish placed in an observation tank avoided intense illumination and preferred dark background. They were attracted to stationary objects in the tank, hiding beneath them when possible. Presented with a depth gradient, a disturbed fish preferred the deepest water. Two or more fish formed a school, and such groups reacted to environmental conditions in the same way as single fish. However, group integration improved as greater numbers were involved.

Blinded fish did not school and swam more slowly and steadily than normal fish.

Photography of groups of Rhinichthys showed that spacing and swimming speeds are variable. Lead fish tended to swim more erratic paths and thus greater distances than all succeeding individuals in the school. Leadership alternated among fish in the group.

Individuals of both species were given visual preference tests to evaluate the effects of number, shape, size, and movement on schooling. All fish preferred large rather than small numbers of their own species. Preference for fish of nearly the same size was noted. Species recognition and shape preference were not highly developed. Both species were attracted to active rather than to sluggish fish. It is suggested that responsiveness to movement is a basic mechanism involved in schooling of Rhinichthys and Semotilus and that other visual preferences may develop from it. No evidence could be obtained for the use of any sense other than sight in the schooling reaction of these minnows.

Both species behave like blinded fish at light intensities below 1.35 luxes (1 lux = 0.0929 foot candles). Group interaction appears and develops to its maximum between 1.35 and 6.70 luxes.

The schooling habit seems to aid Semotilus and Rhinichthys in orientation, feeding, and predator avoidance. These proposed benefits are considered for possible application to other schooling studies.

An explanation of the origin and utility of schooling behavior is presented. The basis of the behavior is considered to be an innate attraction of young fish toward moving objects. The value and degree of expression of the behavior is dependent primarily on the type of environment. Streams, lakes, and pelagic, marine areas are used as examples of habitats in which schooling is found to differing degrees. The possible use of senses other than vision in achieving schooling are mentioned. (Auth. abst.)

1880. Klykov, A. A. 1958. AN IMPORTANT PROBLEM (VAZHNAYA PROBLEMA). Nauka i Zhizn', Moskva, No. 1, p. 79 (In Russian).

This article deals with problems of fish conservation in various rivers where dams constructed for new power-plants hinder seasonal fish migration. (SOV/STEP)

1881. Smirnov, N. N. 1958. LIFE IN WATER RESERVOIRS (ZHIZN' v vodoyemakh). Nauka i Zhizn', Moskva, No. 1, pp. 66-67 (in Russian).

The American scientist Prat and his coworkers discovered that green algae of chlorell produce certain substances which impede the growth of chlorell itself, as well as of other algae and bacteria. The research work done by the French scientist Lefevre proved that the majority of algae showed similar properties. Up to now, blue vitriol was used to destroy these algae but scientists are still looking for more effective algicides. In 1955, the USA scientists Palmer and Malony tested the toxicity of 76 substances applied with green, diatomaceous and bluish green algae. In the USSR tests concerning the application of herbicides for the control of these algae are just being carried out. The use of sodium salt 2 four-dichlorophenoxy-acetic acid together with blue vitriol proved to be very effective. In 1956 at the International Congress of Limnologists in Helsinki, the Finnish biologist Khal'me stated that the presence of zinc has a detrimental influence on the spawn of fish. On the other hand "fertilization" of ponds and certain parts of the sea with various algae in order to bring about an increase in the fish resources have shown satisfactory results. (SOV/STEP)

1882. Dubinin, N. P. 1957. No Title. Znaniye - Sila, No. 6, p. 16 (in Russian).

Three fundamental ways of practical selection have now been developed through experimental genetics. The first one consists in the crossing of genetically pure lines, the second one relates to the influence of high and low temperatures and chemical substances on plants causing specific changes in the cell nucleus. The third method includes radio-selection, and is the introduction of atomic energy into biology and agriculture.

The first Soviet experiments in this field were made by A. Sapegin and L. Delone. Results of their research were published during the last years of the life of Ivan Vladimirovich Michurin, who recommended expanding this work.

The actual epoch of radioselection has only begun; its development was prevented by the widespread theory that radiations are only harmful to organisms. Thorough experimental and practical experiences were necessary to refute this opinion. Now, practical results have been reached, in connection with the development of nuclear physics, the practical utilization of atomic energy and the application of selection in physical research methods. (SOV/STEP)

1883. Gorodnicheva, O. P., and V. V. Novysh. 1957. CERTAIN RESULTS OF TESTING A NEW ELECTROMAGNETIC CURRENTMETER (EMIT) /NEKOTORYYE DANNYYE O REZUL'TATAKH ISPYTANIY ELEKTROMAGNITNOGO IZMERITELYA TECHENIY (EMIT)/. Trudy Nauchno-issledovatel'skogo instituta zemnogo magnetizma, ionosfery i rasprostraneyiya radiovoln, Vol. 12, No. 22, pp. 214-224.

The authors describe tests conducted in the Black Sea (1953) and Baltic Sea (1954) to evaluate a new electromagnetic current-meter applicable in sea navigation and oceanography. It differs from the American model (not specified) by a new two-electrode arrangement: two cables of 100 to 200 meters in length are in tow, and an electrode is placed at the end of each cable. The ends of the cable are 100 meters apart. The diameter of the cables used is either 9 or 12 mm. The speed of the ship does not affect the measurement to any large extent, but weather and salinity effects are noted. Errors in the measurement of velocities of sea currents were less than 1-2 cm per second. The simplicity and reliability of the new method make it particularly applicable to synoptic mapping. There are 6 figures, 1 table and 2 references, of which 1 is Russian. (SOV/STEP)

1884. Novysh, V. V. 1957. DEPTH AT WHICH TO HAUL CABLES AND ELECTRODES OF THE ELECTROMAGNETIC CURRENTMETER (EMIT). /O GLUBINE BUKSIROVANIYA KABELEY I ELEKTRODOV ELEKTROMAGNITNOGO IZMERITELYA TECHENIY (EMIT)/. Trudy Nauchno-issledovatel'skogo instituta zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln , Vol. 12, No. 22, 225-240, (in Russian).

A method was developed to measure the velocities of sea currents in which two cables are towed by the ship. An electrode is placed at the end of each cable. The article discusses the depth of hauling and the distance to be maintained between the two electrodes. These two factors depend mainly on the height of the starting point on board the ship (above sea level). One end of the cable (200 meters in length) is fixed to the ship and the other end is free to carry the electrode; thus the two cables are only partly submerged in water. The problem is reduced to determining the conditions of equilibrium between the two hauled cables and the velocities of the currents. The fundamental equations for the strain developing at any point of the cable are offered by Academician Kochin:

$$(1)\quad \frac{dT}{ds} + \gamma' \sin\alpha + f\cos\alpha = 0$$

$$(2)\quad T\frac{d\alpha}{ds} + \gamma'\cos\alpha - f\sin\alpha - r = 0$$

where ds = section of the cable; T = strain at any point of the cable; γ' = weight of 1 meter of the cable; f = coefficient of friction; r = hydrodynamic volume resistance; and α = the angle between the horizontal and the tangent to the cable at a given point. It was

established that for a properly suspended cable the $\sin^2$ law should be used. In addition, the weight of the cable and the angles of the floating cable must also be taken into account. Equations and formulas with corresponding graphs are given to explain the relationship between the depth of hauling and the velocity of the current. The disagreement between experimental and theoretical results is 1-2 percent. A. N. Krylov, N. Ye. Kochin, and N. A. Zheludev are mentioned. There are six figures, five tables, and five references, of which four are Russian. (SOV/STEP)

*1885. Skryagin, L. 1957. "BOTTLE MAIL" ("BUTYLOCHNAYA POCHTA"). Znaniye - Sila, No. 6, pp. 6-7 (in Russian).

The author states that one of the various methods to investigate sea currents is by "bottle mail."

In 1953, the British National Institute of Oceanography investigated the Gulf Stream to the west of Great Britain. Instead of bottles, 10,000 plastic envelopes were utilized. These were dropped from aircraft over a radius of 800 km. (SOV/STEP)

1886. Aleev, Iv. G. 1956. ON THE FUNCTIONAL IMPORTANCE OF LATERAL (HORIZONTAL) BODY ORIENTATION IN PLEURONECTIFORMES (O FUNKTSIONAL' NOM ZNACHENII BOKOVOGO (GORIZONTAL'NOGO) POLOZHENIIA TELA U KAMBALOOBRAZNYKH (PLEURONECTIFORMES)). Nauk SSSR, Doklady, Vol. 110, No. 4, p. 707.

This article, based on observations of fish in aquaria, describes two positions of flatfishes at rest on the bottom, their rapid "take-off," the importance and function of different fins, and mainly the capacity of this type of fish to turn in a vertical plane. (T. Y. C.)

1887. Ginsburg, A. S. 1957. THE TIME OF CONTACT BETWEEN THE EGG AND THE SPERMATOZOON IN STURGEONS. (VREMIA USTANOVLENIIA KONTAKTA SPERMIIA S IAITSOM PRI OPLODOTVORENII U OSETROVYKH RYB.) Akademiia Nauk SSSR. Doklady, Vol. 115, No. 4, pp. 845-858.

At different periods after impregnation the following steps were taken: (1) the sperm was in activated and fertilized eggs were determined; (2) eggs were fixed for a cytological examination and the progress of spermatozoa along micropylar canals studied. Roe and sperm of the sturgeon Acipenser stellatus Pall. and the Black Sea and Azov Sea sturgeon (A. guldenstadtii colchicus V. Marti) were used. Results showed that the contact between spermatozoon and egg may occur in the short time of 2 seconds and all eggs may be fertilized in 10 to 15 seconds. (T. V. C.)

1888. Kotov, V. L. 1957. MEASURES FOR PROTECTING AND REGULATING THE PACIFIC SALMON FISHERIES (OB OKHRANE I REGULIROVANII PROMYSLA TIKHOOKEANSKIKH POSOSEI. Rybnoe Khoziaistvo, Vol. 33, No. 12, pp. 55-58.

In the northern part of the Pacific Ocean, the annual catch reaches 5 to 6 million centners, or 84 percent of the world salmon production. This article describes the urgent need to protect and regulate the Pacific Salmon Fisheries. To protect salmon reserves and improve conditions for their reproduction, tactics of Japanese Fisheries should be altered, the use of hooks prohibited, the rules of the Convention should be extended to the waters south of the 48° North parallel, including the Island of Hokkaido, salmon fishing in open sea should be restricted, and the distribution of the Japanese flotilla in fishing areas should conform in more detail to the Soviet side. (T. V. C.)

1889. Karpenko, I. M. 1957. RADICAL MEASURE FOR CONTROLLING HEMORRHAGIC SEPTICEMIA IN THE CARP. (RADIKAL'NYI SPOSOB BOR'BY S KRASHUKHOI.) Rybnoe Khoziaistvo, Vol. 33, No. 12, p. 64.

This disease is widely spread in western districts of the Ukrainian SSR. The control method described consists of draining ponds and leaving them dry for one year. Damp spots, canals, and river beds are disinfected, during the summer when they are dry, with quick lime (25 centners per hectare) and hydraulic structures are treated twice with 20% milk of lime. Fish are planted in the spring of the following year. (T. V. C.)

1890. Baranov, I. V. 1957. THERMAL AND HYDROCHEMICAL CONDITIONS OF THE WINTERING OF FISH IN GORKIY AND KUYBYSHEV RESERVOIRS DURING THEIR FIRST YEAR OF EXISTENCE. (TERMICHESKIE I GIDROKHIMICHESKIE USLOVIIA ZIMOVKI RYB V GOR' KOVSKOM I KUYBYSHEVSKOM VODOKHRANILISHAHAKH V PERVYI GOD IKH SUSHCHESTVOVANIIA.) Rybnoe Khoziaistvo, Vol. 33, No. 12, pp. 65-69.

Data on the temperature and chemical composition of water in these reservoirs collected during a study made in March of 1956 are presented. (T. V. C.)

1891. Kruglova, V. M. 1957. INTRODUCING FOOD ORGANISMS AS A MEASURE FOR INCREASING FISH RESOURCES OF RESERVOIRS (INTRODUKTSIIA KORMOVYKH ORGANIZMOV, KAK MEROPRIIATIE DLIA YVELICHENIIA RYBNOI PRODUKTIVNOSTI VODOOMOV). Rybnoe Khoziaistvo, Vol. 33, No. 12, pp. 70-73.

The article discusses the importance of a year-round food supply as a measure for increasing fish resources. In 1951, those organisms characteristic of the salt water shallows around the Caspian Sea which were ecologically most promising were introduced into ponds. The result was very encouraging; by 1955 those organisms introduced served as food for the fish. (T. V. C.)

1892. Musienko, L. N. 1957. YOUNG FLOUNDER (PLEURONECTIDAE) of the FAR-EASTERN SEAS. (MOLOD'KAMBAL (CEM. PLEURONEC-

TIDAE) DAL'NEVOSTOCHNYKH MOREI.) Akademiia Nauk SSSR. Institut okeanologii. Trudy. Vol. 20, pp. 312-346.

The following conclusions are drawn: (i) the young of the majority of flounder species are found at depths of less than 100 m., on sandy soils, at bottom level temperatures of 0°C. to 2°C., and a water salinity of 32.0 to 34.0%; (ii) the young of the flathead sole (Hippoglossoides elassodon) grows better off the coasts of southern Sakhalin than off the coasts of eastern Kamchatka; (iii) the growth rate of the young of the flounder (Acanthopsetta nadeshnyi) in different areas off the eastern shore of Kamchatka hardly differs; (iv) the young of the northern rock sole (Lepidopsetta bilineata bilineata) off the coast of eastern Kamchatka and the Bering Island grow at the same rate but it appears that in the north (Anadyr Bay) their growth slows down; (v) the young of the yellowfin sole (Limando aspera) do not grow as well in the Olyutorski Gulf as in the Kamchatka Gulf, due possibly to the more intensive fishery in the latter; and (vi) the size of flounder yearlings depends chiefly on the time of the hatch of the larvae, those spawned in fall and winter being larger than the ones spawned in summer and fall; starting with the second year the growth of the young of all flounder species studied becomes more or less similar. (T. V. C.)

1893. Kulikova, E. B. 1957. AGE AND GROWTH OF DEEP-SEA FISH (ROST I VOZRAST GLUBOKOVODNYKH RYB). Akademiia Nauk SSSR. Institut okeanologii, Vol. 20, pp. 347-355.

From 1949 to 1953, inclusive, the expeditionary ship "Vitiaz" collected material on deep-sea fish in the Bering Sea and the Sea of Okhotsk, and in the Kurile-Kamchatka Deep of the Pacific Ocean. As age and growth study was made on several species belonging to two families: Myctophidae and Macruridae, the age of Macruridae was determined by examination of scales; absence of distinctive annual rings in Myctophidae made scale analysis impossible. It is known that in most fish, the growth rate decreases at the period of sexual maturity. It is probable that the same occurs in deep-sea fish. Reasons for periodic growth of deep-sea fish is not clear yet; however, its existence merits attention. (T. V. C.)

1894. Anonymous. 1957. THE WATER INDUSTRY AND FISHERIES. J. Brit. Waterwks Ass., Vol. 30, pp. 443-452.

At the 46th Annual Conference of the British Waterworks Association various speakers discussed the effects of the activities of water undertakings on fresh-water fisheries. Reservoirs were said to increase the number of trout and coarse fish, but to have an adverse effect on salmon fishing. The control of the flow of water downstream from a regulating reservoir is an advantage in some respects, but prevents the floods which are thought necessary to induce salmon to enter a river and which clear away water weeds and algae. The cooperation of water authorities and River Boards was recommended to protect the interests of both in the development of surface water for public supplies, and it was suggested that planning should be directed by a central authority. (W. P. A.)

1895. Falkovskaja, L. N. 1956. DISINFECTION OF WATER BY ULTRASONIC WAVES. Hyg. & Sanit., Moscow, Vol. 21, No. 1, pp. 11-14.

The author describes investigations on the bactericidal action of ultrasonic waves on Bact. coli, Bact. aerogenes, and B. Subtilis. The bactericidal action was not affected by the thickness of the water layer up to 10 cm. The main mass of bacteria was killed by exposure for 2-5 sec. The action was independent of turbidity, was equally great on vegatative and spore-forming organisms, and depended mainly on the intensity. At 1.8 W per sq. cm, 99-99.8 percent of the bacteria were destroyed. (W. P. A.)

1896. Merkens, J. C., and K. M. Downing. 1957. THE EFFECT OF TENSION OF DISSOLVED OXYGEN ON THE TOXICITY OF UN-IONIZED AMMONIA TO SEVERAL SPECIES OF FISH. Ann. Appl. Biol., Vol. 45, pp. 521-527.

Experiments were carried out to determine the resistance of rainbow trout, perch, roach, and gudgeon to rapidly lethal concentrations of un-ionized ammonia ranging from about 2 to 8.8 p. p. m. nitrogen, in tensions of dissolved oxygen 53.4 and 96.7 percent of air-saturation value, at 15.2°C. The relation between concentration of un-ionized ammonia and period of survival from a few hours to 13 days was investigated for rainbow trout in 2 tensions of dissolved oxygen, 45.7 and 100.3 percent of air-saturation value, at 20.1°C. It was found that the period of survival of all the species tested decreased with increase in concentration of un-ionized ammonia. A decrease in the concentration of dissolved oxygen increased the toxicity of un-ionized ammonia to all species except gudgeon, for which there was no significant difference in period of survival at the two levels of oxygen. The effect of oxygen in increasing the period of survival was greatest in the lowest concentrations of un-ionized ammonia. The presence of a low concentration of ammonia (not toxic to trout within at least 13 days) did not significantly affect the resistance of perch and roach to lack of oxygen, but did reduce the resistance of rainbow trout. (W. P. A.)

1897. Weiss, C. M., and J. L. Botts. 1957. FACTORS AFFECTING THE RESPONSE OF FISH TO TOXIC MATERIALS. Sewage Industr. Wastes, Vol. 29, pp. 810-818.

Experiments were carried out to evaluate the effect of several environmental factors on the response of fish to toxic materials and on the oxygen consumption of the fish. The fish used in the experiments were fathead minnows, green sunfish, and goldfish, and the toxic material was Sarin (isopropyl methylphosphonofluoridate). The experimental procedure is described. In general, the rate of oxygen consumption of the fish showed an inverse relation

to the toxic response, a decrease in oxygen consumption occurring with increase in time of response to a given toxic concentration. The time of response to the toxic material was directly related to the concentration of dissolved oxygen in the water. At oxygen saturation levels, changes in time of response as a result of laboratory acclimatization are inversely proportional to changes in the oxygen consumption. Acclimatization to the test temperature prior to the beginning of the experiment is therefore necessary to allow for adjustment of the rate of oxygen consumption. (W. P. A.)

1898. Cole, V. W. 1957. LIME TREATMENT OF LAKE REDUCES ACID MINE WASTE POLLUTION. Industr. Wastes, Vol. 2, pp. 100-103.

A description is given of the use of hydrated lime to neutralize pollution by acid mine drainage in Lake Alma, Ohio. A total of 4.75 tons of lime was applied to the lake during 1952, raising the pH value to 7.1. This treatment was sufficient to maintain a minimum pH value of 6.9 during 1953 and 1954 without further additions of lime, and resulted in an increase in numbers of fish, algae and aquatic plants in the lake. The use of 100 tons of crushed limestone as a filter in the stream supplying the lake did not reduce the acidity of the lake. (W. P. A.)

1899. Speranza, N., and C. Serbetis. 1947. THE TOXIC EFFECT OF DDT ON FISH. Prakt. Akad. Athen., 22, pp. 249-255.

DDT in the form of a five percent solution or an emulsion is lethal to Mugil auratus. The effect on other types of sea fish is doubtful if not negative. No experiments were made with freshwater fish. As DDT has been sprayed over lakes for insect control without causing death of fish, the authors conclude that there is no harmful effect. The toxic action of DDT affects the nervous and circulatory systems and not the digestive system. (W. P. A.)

1900. Zorell, F. 1956. TEMPERATURE MEASUREMENTS AND OXYGEN DETERMINATIONS IN LAKE KOCHEL. Limnol. Schr. Reihe, No. 14, pp. 7-30.

Comparison of temperature measurements and determinations of oxygen at different times in Lake Kochel show that conditions have been much altered by the introduction of the discharge from the Lake Walchen power works. The effects of the discharge and of the inflow of the Loisach and the difference between conditions of flow and stratification in Lake Kochel and other lakes with flowing water are considered. (W. P. A.)

1901. Pentelow, F. T. K., I. R. H. Allan, D. W. M. Herbert, and J. S. Alabaster. 1957. SEWAGE EFFLUENTS AND THEIR EFFECT ON FISH. Surveyor, Lond., 116, pp. 986-988.

Experiments to determine the effects of sewage-works effluent on fish in the river Colne are described. An analysis of the effluent is given in a table. The effects on fish living in the effluent of low oxygen content, high carbon dioxide content, the presence of un-ionized ammonia, synthetic detergents, and metals are discussed. The experiments showed that coarse fish are capable of living for long periods in undiluted sewage-works effluent, and when fish did die it was usually because the concentration of oxygen in the effluent had fallen too low. (W. P. A.)

1902. Reish, D. J. 1957. EFFECT OF POLLUTION ON MARINE LIFE. Industr. Wastes, 2, pp. 114-118.

The Consolidated Slip and East Basin area of Los Angeles Harbour was dredged in 1953. Between 1951 and 1955 physical, chemical and biological surveys were carried out so that analytical data for conditions before and after dredging were available. The organic carbon concentration of the substrate varied from 0.6-10.7 percent, the higher figures occurring near the sluice gates; an increase in organic carbon with respect to time was noted at the stations within the dredged area. The influence of dredging upon the bottom-dwelling animals is summarized in a chart and table. An increase in the number of species occurred shortly after dredging, then, with each successive survey this number diminished. The very polluted bottom, which after dredging was restricted to the area represented by two stations, gradually extended into the East Basin. An equilibrium, with respect to bottom conditions, was reached a year after dredging. (W. P. A.)

1903. Simmons, J. D., N. L. Nemerow, and T. F. Armstrong. MODIFIED RIVER SAMPLING FOR COMPUTING DISSOLVED OXYGEN SAG. Sewage Industr. Wastes, 29, pp. 936-943.

Studies were made to determine the practical minimum number of samples required to determine the dissolved oxygen depletion in a stream by the statistical methods of Churchill and Buckingham (see Wat. Pollut. Abstr., 1956, 29, Abstr. No. 2385). Samples were collected from the Neuse River, near Raleigh, N. C. Six sampling stations were used, and a stage-discharge relation was established at each sampling site. It was found that the range and distribution of the data collected are more important than the number of samples. If each sampling station is observed under maximum or minimum conditions of one of the 3 stream variables (dissolved oxygen, B.O.D., and temperature), only 6 samples are required to produce practical results. (W. P. A.)

1904. Frolander, H. F. 1957. A PLANKTON VOLUME INDICATOR. Cons. Int. Explor. Mer., 22, pp. 278-283.

An illustrated description of a sampler used for measuring the volume of plankton by displacement, is given, and a comparison of the volumetric difference obtained in duplicate analyses is shown in a table. The instrument was tested using samples collected in a Clarke-Bumpus sampler. In compari-

son with other apparatus used, the apparatus described is quicker, and ensures standardized treatment of all samples; more water is removed than by the conventional draining method; the organisms are handled in a water medium which minimizes damage and permits further identification and accurate counts; the volume measurements are reproducible; and the instrument is easily constructed. The disadvantages of the apparatus are the possible variations in porosity of the filter discs, and the fact that large or gelatinous forms may cause difficulty in measurement. (W. P. A.)

1905. Paquette, R. G., and H. F. Frolander. 1957. IMPROVEMENTS IN THE CLARKE-BUMPUS PLANKTON SAMPLER. Cons. Int. Explor. Mer., 22, pp. 284-288.

The Clarke-Bumpus sampler for measuring the volume of plankton in water is described. The apparatus consists of a small, metered, net-towing device which has been extensively used because of its convenient size, and the fact that it may be opened and closed at chosen depths while the passing water is measured. Another advantage is that several samplers may be operated in series. Simple modifications are described which have made the instrument easier to cock, have improved the opening and closing mechanism, and have ensured that the instrument is reliable when in operation. Some common flaws in construction are indicated, and small improvements are outlined. It was noted that the measuring device of the apparatus fails when the net becomes badly clogged. Diagrams of the original sampler, and of the modifications made to it, are included. (W. P. A.)

1906. Grøntved, J. 1957. A SAMPLER FOR UNDERWATER MACRO-VEGETATION IN SHALLOW WATERS. J. Cons. Int. Explor. Mer., 22, pp. 293-297.

An instrument designed for taking samples of macroflora in shallow water is described and illustrated. The sampler is able to take vertical and horizontal cuttings of the higher plants present when lowered into the water. Diagrams of the apparatus are included. The sampler has been used for quantitative investigations of the flora in several areas on the coast of Denmark, with a view to their reclamation for use as agricultural land. Work carried out on 2 such areas, Naeraa Strand, a sheltered bay, and Dybsø Fjord is described, and results of the analysis of the dry matter contained in the higher algae and plants found, are given. Although the use of the sampler causes some damage to the plants, it was found that the instrument was satisfactory for the purpose of obtaining analysis of dry matter. (W. P. A.)

1907. Mosevich, M. V., and V. M. Danilevich. 1955. THE ROLE OF BIOCHEMICAL PROCESSES IN THE PHOSPHORUS CYCLE IN RESERVOIRS. Bull. Inst. freshw. Fish., Leningr. 36, pp. 149-164.

Bacteria capable of transforming difficultly soluble phosphorus to soluble phosphorus were found in the bottom deposits of almost all lakes examined, which were mostly near the Don River. The amount of phosphorus made soluble depends on the activity of these bacteria, and the bacteria participating in the phosphorus cycle are related to those affecting the nitrogen cycle. In general, phosphorus will be easily made soluble if much organic matter is present. In laboratory experiments it was found that solubilization of phosphorus was accelerated by the addition of trivalent iron, and the activity of ammonifying and denitrifying bacteria was increased by the addition of water with a high humin content. (W. P. A.)

1908. Mosevich, N. A., and M. M. Alferovskaya. 1955. PHOSPHORUS COMPOUNDS IN THE WATER AND IN THE BOTTOM OF LAKES. Bull. Inst. Freshw. Fish., Leningr., 36, pp. 165-183.

The occurrence of phosphorus in lake water and bottom deposits is discussed. The concentration of phosphorus in bottom deposits is higher than the concentration in soil, but much of it is insoluble. The ratio of inorganic to organic phosphorus is higher in lake deposits than in soil. More soluble phosphorus is found in the bottom deposits when phytoplankton growth is greatest. (W. P. A.)

1909. Ives, K. J. 1957. CONTROL OF ALGAE IN RESERVOIRS. Wat. & Wat. Engng, 61, pp. 387-389.

The author discusses the control of algal growths in reservoirs by elimination of nutrients from the water, by removal of river plankton from the influent, and by the use of algicides. The value of copper sulphate, chloramine, chlorine, lime, quaternary ammonium compounds, naptho-quinones, activated silver and antibiotics as algicides is considered. (W. P. A.)

1910. Dong, G., R. L. Giusti, and A. E. Greenberg. 1957. ALKALINITY MEASUREMENTS IN WATER. Wat. & Sewage Wks., 104, pp. 509-511.

The terms "alkalinity", "pH value", "equivalence point" and "end point" are defined. The theoretical calculation of equivalence points and end points in the titration of sodium carbonate and sulphuric acid is explained and a titration curve showing bicarbonate and carbonic acid equivalence points is given. The choice of an end-point and a suitable indicator for the measurement of total alkalinity is discussed. An end-point pH value of 4.8 for all alkalinity titrations and a methyl purple indicator are considered suitable. Tables are given showing equivalence points for different alkalinities and the errors arising when end-point pH values of 4.3 and 4.8 are used. (W. P. A.)

1911. Armstrong, F. A. J. 1957. THE IRON CONTENT OF SEA WATER. J. Mar. Biol. Ass. U. K., 36, pp. 509-517.

It is known that much of the iron in sea water

is in particles which can be removed by filtration. A method for the routine determination of total iron in sea water has been developed. The water is acidified to about 0.13N with hydrochloric acid and is heated at 140°C in an autoclave for 5 hours. Iron is then determined absorptiometrically with 1:1 phenanthroline after reduction with hydroxylamine hydrochloride. The collection and storage of samples are described. The results obtained on samples of water from the English Channel and the Bay of Biscay are given in tables. (W. P. A.)

1912. Griffiths, V. S., and M. I. Jackman. 1957. THE WINKLER METHOD FOR DISSOLVED OXYGEN DETERMINATION. Analyt. chim. acta., 17, pp. 603-605.

A modification of the Winkler method for the determination of dissolved oxygen is described, in which the final iodine titration is carried out potentiometrically, using a glass reference electrode and a platinum indicator electrode. The method can be made automatic. (W. P. A.)

1913. Niles, T. M. 1957. DISPERSAL OF POLLUTION BY TIDAL MOVEMENTS. Proc. Amer. Soc. Civ. Engrs. 83, SA5, Pap. No. 1408, 18 pp.

In portions of streams where tides cause substantial flow reversals, the capacity for assimilating pollution is greatly increased as a result of wide dispersal and mixing over large areas. A description is given of tidal movements, calculations of the tidal prism, and the way in which entering pollution is dispersed, and the difficulty of applying oxygen balance computations to tidal waters is indicated. Results of surveys on the Delaware River at Philadelphia and the Potomac River at Washington are given, including information on the relation between pollution loads and depletion of dissolved oxygen at various stream flows. For both these rivers, and possibly for other tidal streams, within the range of low stream flows obtainable by river regulation, little improvement in capacity to assimilate pollution may be gained by augmenting the minimum natural flows. (W. P. A.)

1914. Herbert, D. W. M., G. H. J. Elkins, H. T. Mann, and J. Hemens. 1957. TOXICITY OF SYNTHETIC DETERGENTS TO RAINBOW TROUT. J. Wat. Waste Treatm. J. (Wat. Sanit. Engr.), 6, pp. 394-397.

A series of experiments has been made to determine the toxicity of synthetic detergents to rainbow trout (Salmo gairdnerii Richardson). Trout not more than 18 months old were used for all experiments and trout used for each experiment had similar environmental histories. A mixture of seven proprietary detergents was prepared in ten concentrations and the concentration of surface-active material in each was determined and expressed as Manoxol O. T. The dilution water used for one experiment was dechlorinated tap water and for the others, water pumped direct from a borehole. Descriptions are given of experiments to determine the toxicity of increasing concentrations of a mixture of synthetic detergents at 17.5°C; to determine the toxicity of "building ingredients" in detergents; and to compare the toxicity of a mixture of synthetic detergents with a solution of sodium tetrapropylene benzene sulphonate. A synthetic sewage was prepared, detergents were added and the sewage was treated on pilot-scale percolating filters and in an activated-sludge unit. The toxicity of both of the effluents was found to be less than that of a solution of synthetic detergents in borehole water. Experiments to determine the effects of low oxygen tension showed that concentrations of synthetic detergents which would be too low to cause 50 percent mortality in three months in a well-oxygenated water caused deaths when the dissolved oxygen concentration was at a low but not lethal value. However, when these experiments were repeated using sewage effluents containing residual detergent, it was found that the period of survival was not significantly less than the period of survival in control effluents containing no detergent. It is concluded that in rivers in Great Britain synthetic detergents are unlikely to be a serious danger to fish, as most of them will be in the form of residual material remaining after sewage treatment, and their concentration in river water will usually be less than 3 p. p. m. Results of all experiments are given in tables and graphs. (W. P. A.)

1915. Boschetti, M. M., and T. F. McLoughlin, 1957. TOXICITY OF SODIUM ARSENITE TO MINNOWS. Sanitalk, 5, No. 4, pp. 14-18.

The authors describe experiments to determine the median tolerance limits of the minnow, Notropsis hudsonius, to sodium arsenite. The results are given in tables. Median tolerance limits, under laboratory conditions, were 45 p. p. m. arsenic for 24 hours, 29 p. p. m. for 48 hours and 27 p. p. m. for 72 hours. Fish not killed after 72 hours in concentrations of 30-35 p. p. m. arsenic showed damage to fins and scales, diarrhoea, heavy breathing and haemorrhage around the fin areas. Lower concentrations of arsenic had a corrosive effect on fin and tail tissues after 96 hours, but in some cases regeneration of the tissues occurred when the fish were transferred to arsenic-free water. No mortality occurred in concentrations of 15 p. p. m. arsenic, which is the highest concentration used for control of water weeds. (W. P. A.)

1916. Türcke, P. 1957. EXPERIENCES IN THE CONTROL OF "HARD" FLORA ON POND BEDS WITH AGENTS CONTAINING CHLORATE. Dtsch. Fisch Ztg, 4, No. 2, pp. 51-58.

Numerous experiments show that chemical control of weeds with powdered materials containing chlorate is most effective on dry pond beds in autumn but can be used in spring if the soil is not too wet. With correct application no risk exists to fish or other organisms as the material seeps into the soil before the pond is filled. Application

to filled ponds has no effect because of dilution. (W. P. A.)

1917. Millis, L. 1958. UNDERGROUND ABSTRACTION OF WATER AND ITS EFFECT ON FISHERIES. Salm. Trout Mag., No. 152, pp. 12-21.

The availability of water supplies in the British Isles, and particularly in southeast England is discussed. The southeast area of England is rich in sedimentary deposits which have the property of holding water, so forming an underground reservoir. To prevent exhaustion of this underground supply, it is recommended that water supplies should be taken from surface sources in winter and from underground sources only in summer. The surface sources may be rivers and streams, or the springs appearing at the perimeter of a particular area of land. Any excess water at the perimeter of an area of land, or in the rivers, during winter, could be treated and pumped back into the underground reservoirs; in some parts of England the loss of excess water in winter could be avoided by pumping it from the streams into disused coal pits. As a result of the balancing of excess winter rainfall against the drier summer periods, the rivers and streams would hold larger quantities of water in summer, would have a better diluting power, and would therefore be less adversely affected by pollution. The abstraction of ground water affects fisheries in so far as it affects the maintenance and flow of the streams. (W. P. A.)

1918. Barrett, S. G. 1958. OVERGROUND ABSTRACTION IN RELATION TO FISHERIES. Salm. Trout Mag., No. 152, pp. 22-37.

The effect of impounding reservoirs on the flow in rivers and the amount of compensation water to be provided are discussed. Cumulative flow frequency curves for the river North Tyne indicate that the existence of reservoirs has little effect on the river when the rate of flow is high. The problem of insufficient flow of water at fish spawning grounds could be solved by amendments to the compensation water agreement, or by recirculation of water from a point in the river downstream. With regard to direct pumping of water from a river, it is considered that for rivers having a "steady" flow, the regular abstraction of a reasonable amount is usually acceptable; in rivers which show wide fluctuations in the rate of flow, regular abstraction may be noticeable in a dry summer; the flow will not be diminished appreciably, however, if sewage and industrial wastes are returned to the river after suitable treatment and at points adjacent to the respective intakes. Such return of water to the river is impossible when water is used in agriculture for spray irrigation. The fisheries of British rivers suffer from the effects of low water every summer; the damage caused by abstraction of water can be estimated by determining the number of additional days that the river is unfishable or less useful for fishing. (W. P. A.)

1919. Anonymous. 1957. EIGHTH ANNUAL REPORT TO THE SUPERVISORY COMMITTEE FOR BROWN TROUT RESEARCH, 1955-1956. Scottish Home Department, Freshwater and Salmon Fisheries Research, H. M. Stationery Office, Edinburgh, 12 pp.

The report of the Brown Trout Research Laboratory for the year ending 31st October 1956 contains information on laboratory and field work carried out during the year. Studies on the "homing" behaviour of trout during spawning runs have been continued. Experiments involving temporary plugging of the olfactory pits did not substantiate the theory that fish recognize their home stream by odours. On the basis of earlier work on the conditions under which trout spawn, existing stream beds have been modified and new channels constructed, and these have been used by the trout for the construction of redds. A study is being carried out in Loch Garry on the increase in the growth rate of fish when new land is flooded; it appears that initially earthworms form a large part of the food of the trout. No further fertilization of lochs has been carried out, but regular visits have been made to the Scourie area to follow the results of earlier fertilization experiments. Work on the general assessment of the productivity of Scottish freshwaters has continued, and the use of microscopic plants and bottom fauna as indicators of productivity is being investigated. (W. P. A.)

1920. West, P. W., and H. Coll. 1957. DIRECT SPECTROPHOTOMETRIC DETERMINATION OF CHLORIDE ION IN WATER. J. Amer. Wat. Wks. Ass., 49, pp. 1485-1492.

A comparison was made of the spectrophotometric method for the determination of chloride in water with the standard Mohr and mercuric nitrate methods. The results, which are given in tables and discussed, indicate that the proposed spectrophotometric method compares favorably with the other two methods as regards reliability, precision and accuracy. Only a small volume of sample is required and the operations involved are simple. It is felt that only in a few exceptional cases will interference from other ions render the spectrophotometric method inapplicable. (W. P. A.)

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